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WHO HAS A THIRD CHILD IN CONTEMPORARY NORWAY?

A REGISTER-BASED EXAMINATION OF SOCIODEMOGRAPHIC DETERMINANTS

BY

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PREFACE

This is the second report from a project in which recent fertility trends are studied on the basis of data from the censuses and the Central Population Register of Norway. The first report was called "Sociodemographic differentials in the number of children. A study of women born 1935, 1945 and 1955" (Report 89/7). The project is carried out by the Central Bureau of Statistics with financial support from the Norwegian Research Council for Science and the Humanities.

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Arne Øien

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ABSTRACT

Trends and variations in third birth probabilities from the mid-1960s to the mid-1980s are examined with individual life histories from the Central Population Register of Norway and information from the Population Censuses of 1960, 1970 and 1980.

During the late 1960s and most of the 1970s it became gradually more common to stop childbearing after the second birth, but the decline in third birth probabilities came to a halt at the end of the 1970s. The development has been almost parallel in the regional groups that are studied, but there appears to have been a slight upturn in non-rural areas among women delivering their second child in the late 1970s. For the women with a second child in this period there has also been a positive effect of education. For instance, those who have taken a university degree, have had a higher subsequent fertility than those with only the compulsory education, in spite of their later entry into motherhood. When the age at second birth and other sociodemographic factors are controlled, the education exerts a positive influence also prior to the mid-1970s. One should be aware, however, that there is still no evidence from Norway that goes counter to the traditional inverse relation between education and total cohort fertility.

Place of residence, the mother's age at second birth, and the interval between first and second child are strong determinants of third birth probabilities. Besides, religious attitudes, which are somewhat inadequately measured, appear to be closely related to reproductive behaviour among two-child mothers. The analysis casts some doubt on the relative importance of economic factors. Full-time employment for the mother the year after the second birth, a variable with considerable limitations as an indicator of the real work commitment, has only a very weak negative effect on subsequent fertility. Furthermore, it turns out that the husband's income at that time also has a weak negative net effect.

1. INTRODUCTION [1])

1.1 Brief review of the Norwegian setting

Prior to the demographic transition Norwegian women had on average 4.5 children, but during the first three decades of the 20th century fertility declined steeply, so that the cohort fertility of women born in 1905 was as low as 1.96 (Brunborg, 1988). This is well below replacement level, which at that time was about 2.5, and with current mortality rates and sex ratio is 2.08. The downward trend was succeeded by a temporary upsurge, resulting in a cohort fertility of about 2.5 for women born in the mid-1930s. During the 1960s and the 1970s Norway and several other industrialized countries have witnessed a second drop in fertility - occasionally referred to as the second demographic transition (van de Kaa, 1987). Women born in 1945 have had 2.2 children on average, while those born in the mid 1950s are likely to terminate the fertile period of their lives with 1.8-1.9 children. Younger cohorts may exhibit even lower figures, though there are also indications that the decline has been brought to an end. The total period fertility rates dropped to an all time low of 1.66 in 1983 and 1984, after having remained below 1.8 since 1977, but a slight increase has occurred recently - mainly because of the realization of delayed first births among women born in the late 1950s or in the 1960s. The total fertility rate in 1988 was 1.84, and preliminary figures for 1989 are 1.88.

The drop in total cohort fertility from about 2.5 for the women born during the depression to below replacement level for those born during the 1950s has been examined by Kravdal and Brunborg (1988). Their work clearly demonstrates that the drop is primarily due to an increasing tendency to stop childbearing after the second birth. For instance, 64 per cent of the women who had a second birth in 1964 and were 26 years at that time, had a third birth within 10 years, while the corresponding proportion was only 39 per cent 10 years later.

1.2 The focus on third births

Resorting to simple arithmetic, we briefly illustrate the importance of third births for the cohort fertility. If we assume that 10 percent of a cohort remain childless, that 10 per cent have only one child by the end of their fertile period, that 20 per cent of the mothers with three children eventually have an additional birth, and that no women have a fifth birth, the relation between parity three progressions and total cohort fertility is as follows: With 20 per cent progressions the fertility is 1.89, with 40 per cent it is 2.08, and with 60 per cent it is 2.28.

The objective of this report is to gain further insight into the development of third birth probabilities in Norway. Having the focus on only one particular parity transition is in line with previous well known demographic research, for instance the study of third births by Westoff et al. (1963). Also the analysis of the Swedish 1981 Fertility Survey is based on models of single demographic

[1]) Comments from Helge Brunborg, Jan M. Hoem, José Gomez de Leon, Per Sevaldson and Lars Østby are gratefully acknowledged. Liv Hansen has assisted with typing the text and tables and drawing the figures.

events (e.g., third birth studies by Hoem and Hoem, 1989; Murphy, 1989), and this reflects well the sequential nature of the decisions. We also mention that an Anglo-Swedish co-operation has resulted in an analysis of third births in Britain based on the same methods and variables as in the Swedish study (Wright et al., 1988).

Previous investigations of Norwegian data have revealed that the probability of having a third child within 5 years after the second birth decreased from the mid-1960s to the end of the 1970s - in parallel with the 10-year probabilities referred above - and subsequently levelled off (Kravdal and Brunborg, 1988). This was observed on a national level, controlling only for age at second birth. In this report we intend to find out whether the same trend appears in all regions of Norway and for all educational groups. The influence of marital break-up is also examined.

We recognize the inherent limitations of an analysis dealing only with the transitions from parity two to parity three. Intercohort changes in this transition intensity explain a major part of the decline in total cohort fertility in Norway, and also intracohort differentials in these two measures do generally go hand in hand. However, some fertility determinants may have a considerable impact also on earlier stages of the family building, so that a focus on third births may give a too fragmentary picture of the procreative behaviour. It has been emphasized in the scholarly literature that the effects of the various sociodemographic factors may vary considerably with parity (e.g., Namboodiri, 1972, 1974), and even change sign. In the present analysis the implications of conditioning on the second birth are discussed in the context of educational differentials and on a few other occasions, partly with reference to the previous work on total cohort fertility (Kravdal, 1989).

1.3 Data source, analytical approach, and organization of the report

The analysis is based on individual female birth and marriage histories extracted from the Central Population Register of Norway and linked with information from the Population Censuses of 1960, 1970 and 1980 (Kravdal, 1989). Unfortunately, the data set does not permit an elaborate analysis of the changes in third birth probabilities during the last couple of decades. For instance, we know the place of residence and the educational level at the time of the second birth for women having their second birth around 1980, but not for those giving birth in, say, 1975. The alternatives are to use the information from the 1980 or the 1970 census. This, of course, represents a major problem, not least for variables like occupation, income and labour force participation, which tend to change quite a lot over the life course - partly as a response to previous reproductive behaviour.

The problem is solved by dividing the analysis into two parts. In chapter 4 there is a description of how the third birth probabilities have changed for women delivering their second child during 1964-1979. The trends are studied for different regional and educational groups, controlling for age at second birth and marital status, and the results are discussed in the light of the data limitations referred above.

Chapter 5 is devoted to a more detailed investigation of third birth determinants among women with a second birth in 1969 or 1979. For these women we have access to some important socioeconomic characteristics one year after the

delivery. This analysis is confined to married women, who are by far the largest group. Separate models are estimated for those of the married women who have gainful employment one year after their second birth.

A major advantage of our analytical framework is that we measure the relations between a variety of sociodemographic factors and the subsequent fertility. Certainly, the fact that one event occurs before another does not necessarily imply that the former is the cause and the latter the effect, but we are at least closer to drawing conclusions about causality than we were in our previous study (Kravdal, 1989), where the total number of children at a particular age was calculated according to individual characteristics 4 years earlier (e.g. age 39 and 35, respectively). The approach used in the present report opens up for more insightful analysis of the association between economic factors and fertility, in which we have taken a particular interest.

With a data source based on administrative registers and censuses, only some standard sociodemographic variables are available. We selected a few purely demographic characteristics (age, marital status, interval between previous births), and some socioeconomic variables (education, occupation, labour force participation, income) that have received much attention in fertility research. Moreover, place of residence, which is known to be an important determinant of reproduction in Norway, has a crucial position in our exploration. We have also included religious denomination and timing of first birth relative to marriage.

Most variables refer to the woman, but there are also some that refer to the husband or to the couple as a unit. We hold the view that it is important to include husband's characteristics, as a childbirth for married women usually is an outcome of a joint decision taken by the couple, reflecting both spouses' preferences, resources etc.

The results are summarized in chapter 6, where the perspective is also broadened through the reference to factors not included in the analysis.

2. DATA

2.1 Register and census data

Our analysis is based on birth and marriage histories extracted from the Central Population Register of Norway and linked with information from the three latest Population Censuses (1960, 1970 and 1980). The data file comprises all women born 1935-1965 who have received a Norwegian personal identification number. The individual birth histories are almost complete up to the end of 1984. Except for a few of the children born before 1964, when the Central Population Register was established, all live-born children are registered as well as the children the woman has adopted. The marriage histories are not complete for women born during the period 1935 to about 1945, as we do not know the exact date of marriage for those who married prior to 1964. We know the year of marriage for women who were still married in 1970, but not for those who had already divorced, separated or become widows at that time.

2.2 Definition of variables

The investigation is almost entirely based on categorical variables. Certainly, there are good reasons to treat age, birth interval, educational level and income as continuous covariates (and include them, for instance, as second degree polynomials). Above all, the computing-time (CPU-time) would have been shorter. Categorical variables give more flexibility, however. A major problem is that it may be a difficult task to choose appropriate categories. An experimental, and far from elegant, approach has been taken in this analysis: Several initial runs are made (with categorical as well as continuous variables) to uncover the empirical pattern, and the categories in the final models (e.g. tables 5.1-5.3) are defined so that the important structures appear.

In the remaining part of this section there is a detailed description of the variables used in the analysis.

Demographic variables:

With the available data set we had to restrict ourselves to formal marital status, rather than actual cohabitational status. Three catagories are used for marital status: never married, living in a first and never broken marriage, all other situations (including widows, divorcees, remarried and those who have re-entered a marital union after a temporary break-up).

Two other important demographic variables are age of the woman at second birth and age difference between the spouses. Only women aged 20-34 are included in the analysis (except tables 4.5 and 4.6). The major proportion of second births occur within this group, and for births in 1969 the file does not even permit analysis of women older than 34 years. We have used 3- or 5-year age groups.

The interval between first and second birth is also taken into consideration in our models. Three groups are defined: 0-23 months, 24-47 months, and more than 48 months.

The final demographic variable is timing of first birth relative to marriage The three categories are: first birth prior to marriage, first birth within 0-7

months of marriage, and first birth more than 7 months after marriage. For some women only the year of the marriage is known (if it is contracted before 1964). These women are excluded when the effect of first birth timing is estimated.

Socioeconomic variables:

The educational attainment of woman and husband refers to the highest education finished at the time of the census. This education is defined by a 5-digit code (see Vassenden, 1987), where the first digit indicates the length of the school attendance normally required to take this education. The 7 values of the first digit and the corresponding school attendance is as follows:

2: 7-9 years school attendance
compulsory education
3: 10 years school attendance
lower secondary education
4: 11-12 years school attendance
upper secondary education, e.g. "eksamen artium"
5: 13-14 years school attendance
e.g. nurses, teachers in primary school
6: 15-16 years school attendance
e.g., university bachelor's degree
7: 17-18 years school attendance
e.g., university master's degree
8: 19 years school attendance or more
e.g., Ph.D degree

Note that an education is not registered before it is finished, i.e. when the examination is passed. For instance, a woman taking a 3-year education in nursing directly after secondary school will in a census be registered as having a level corresponding to 11-12 years school attendance till she has passed her final examination.

The same categories are used for the educational level of the woman's parents (defined as the highest level either parent has attained according to the 1960 census), except that there is an additional group consisting of women who did not live with their parents in 1960.

For the woman's occupation (included in our models only for women who had more than 100 hours of gainful employment the year before the census) we have chosen the following categories. Reference to occupational standard codes (see Vassenden, 1987) is in parenthesis:

technical, scientific work (codes 00-02)
medical work (codes 03-05)
pedagogical work (code 06)
clerical work (codes 21-29)
sales work, commerce (codes 30-39)
agriculture, fishing (codes 40-49)
industry, craft (codes 70-89)
hotel and restaurant work, charwork (codes 91-93)

all other occupations (incl. missing information)

For husband's occupation the following categories are used:

technical, scientific work (codes 00-02)
medical work (codes 03-05)
pedagogical work (code 06)
administration (codes 10-11)
clerical work (codes 21-29)
sales work, commerce (codes 30-39)
agriculture, fishing (codes 40-49)
transport, communications (codes 60-69)
industry, craft (codes 70-89)
all other occupations (incl. missing information and a few not employed)

Unfortunately, we are not able to distinguish men with missing value for occupation and those who are not employed. A separate indicator for male labour force participation was left out of the data by mistake, but it is known from other sources that an overwhelming majority of the men who are married to mothers with small children are employed (Iversen, 1986).

Labour force participation for the woman is defined in the census as the number of hours worked during the year prior to the census (e.g., 1 November 1979 to 1 November 1980). 5 categories are defined:

not employed (incl. missing information)
100-499 hours
500-999 hours
1000-1299 hours
1300 hours or more

The exact number of hours is not given.

In our models we have preferred to have only 3 groups: not employed, 100-999 hours (part-time), and 1000 hours or more (full-time).

The income concept that is primarily used for the husband is relative income. This is defined as actual income divided by expected income, where the expected income is that predicted by his age, educational level and occupation. The parameters in the actual income model are estimated by OLS-regression performed on the same population as the one used for modelling third birth probabilities. Three or six groups are used for relative income. Typically, about 15 per cent have an actual income more than 25 per cent lower than the expected (relative income less than 0.75), and another 15 per cent have an actual income more than 25 per cent higher than expected (relative income more than 1.25).

The income data were not collected as part of the censuses, but added to the census files by matching with the tax register. The actual income in the 1970 census file is defined as net income from 1 January 1970 to 31 December 1970, while the 1980 census refers to the part of the income from 1 January 1980 to 31 December 1980 on which pension contributions are based. This difference in the

definition makes it difficult to compare the income levels simply by correcting for the inflation rate.

We also refer to models where the actual income of the husband is included - either as a continuous variable or with categories defined as follows:

	AMOUNT (in 1000 NOK)	PER CENT OF THE MALE MARRIED POPULATION IN THIS INCOME CATEGORY
1970 census:		
very low income:	1-24	16.5
low income:	25-29	17.8
slightly lower than average:	30-33	18.4
slightly higher than average:	34-37	15.3
high income:	38-44	16.2
very high income:	45+	15.8

	AMOUNT (in 1000 NOK)	PER CENT OF THE MALE MARRIED POPULATION IN THIS INCOME CATEGORY
1980 census:		
very low income:	1-73	16.7
low income:	74-83	17.1
slightly lower than average:	84-91	15.9
slightly higher than average:	92-101	16.2
high income:	102-118	17.1
very high income:	119+	17.0

For the women (in the labour force) the calculations are based on actual income exclusively. As with other variables several experiments were performed. We finally settled on 4 categories, where the low and high income groups comprise about 25 per cent of the women.

	AMOUNT (in 1000 NOK)	PER CENT OF THE FEMALE MARRIED EMPLOYED POPULATION IN THIS INCOME CATEGORY
1970 census:		
0 income:	0	27.2
low income:	1-10	27.5
medium income:	11-20	18.6
high income:	21+	26.7

	AMOUNT (in 1000 NOK)	PER CENT OF THE FEMALE MARRIED EMPLOYED POPULATION IN THIS INCOME CATEGORY
1980 census:		
0 income:	0	4.1
low income:	1-15	22.4
medium income:	16-49	49.2
high income:	50+	24.3

Regional variable:

The regional variable has 10 categories. For each of the five main regions - Eastern Norway, Southern Norway, Western Norway, Middle Norway and Northern Norway - there is a division into non-rural and rural districts. Places classified as non-rural are settlements with at least 200 inhabitants and usually less than 50 meters between residences.

In several calculations Southern and Western Norway are merged together, and Middle and Northern Norway are merged together.

Couple's religion:

The following four categories are used:

both spouses members of the Norwegian Church
both spouses members of another religious society
none of the spouses members of a religious society
all other combinations

2.3 Population included in the regression models

In the regression models in chapter 5 only women who were living in a first, never broken union at the second birth and throughout the entire interval under study are included. For a few of these women information on husband's education is missing. These couples are excluded from the analysis. For about 1 per cent of the remaining couples the husband's income is missing or 0. These are also excluded.

The population used in the regression models comprises about 15000 married women with a second birth in 1969 and about 14000 married women with a second birth in 1979. The distribution over the categories is shown in tables 2.1 and 2.2 for all married women and employed married women, respectively.

Table 2.1 Per cent distribution of married[1]) women over the categories

		Second birth 1969	Second birth 1979
WOMAN'S AGE	20-22	20.0	10.7
	23-25	35.9	28.7
	26-28	24.2	30.5
	29-31	13.5	20.3
	32-34	6.4	9.8
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	19.5	13.9
	Husband 3-5 ys. older	30.0	31.5
	Husband 0-2 ys. older	40.2	43.6
	Woman older	10.3	11.0
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	33.8	13.3
	24-47 months	46.7	51.9
	48+ months	19.5	34.8
WOMAN'S EDUCATION	7- 9 ys. school attendance	59.9	34.0
	10 ys. school attendance	23.0	35.5
	11-12 ys. school attendance	8.9	12.1
	13-14 ys. school attendance	6.7	12.7
	15+ ys. school attendance	1.5	5.7
HUSBAND'S EDUCATION	7- 9 ys. school attendance	49.5	33.6
	10 ys. school attendance	18.2	20.9
	11-12 ys. school attendance	16.1	21.1
	13-14 ys. school attendance	8.7	11.1
	15-16 ys. school attendance	2.6	5.6
	17+ ys. school attendance	4.9	7.7
WOMAN'S LAB. FORCE PARTICIP.	Not employed (less than 100h)	81.6	62.3
	100-999 hours	10.3	27.0
	1000+ hours	8.1	10.7
HUSBAND'S OCCUPATION	Technical, scientific work	8.3	11.6
	Medical work	1.3	2.3
	Pedagogical work	5.8	6.7
	Administration	3.7	6.1
	Clerical work	5.8	4.4
	Sales work, commerce	8.0	7.4
	Agriculture	6.7	5.6
	Transport, communications	11.0	8.5
	Industry, craft	40.9	35.5
	Other occupations	8.5	11.9
HUSBAND'S RELATIVE INCOME	-0.75	15.0	11.7
	0.76-0.90	17.0	20.1
	0.91-1.00	15.5	20.3
	1.01-1.10	16.3	16.7
	1.11-1.25	17.1	15.3
	1.25+	19.1	15.9

cont.

Table 2.1 cont.

		Second birth 1969	Second birth 1979
PLACE OF RESIDENCE	East, non-rural	35.8	34.1
	East, rural	11.6	10.3
	South and West, non-rural	21.4	24.3
	South and West, rural	10.3	11.8
	Middle and North, non-rural	13.3	13.3
	Middle and North, rural	7.6	6.2
FIRST BIRTH TIMING	First birth before marriage	8.3[2])	11.4[2])
	First birth within 7 months of marriage	50.5[2])	32.8[2])
	First birth after 7 months of marriage	41.2[2])	55.8[2])
PARENTS' EDUCATION	Not living with parents, or education unknown	9.7	0.1
	7- 9 years school attendance	81.8	87.9
	10-12 years school attendance	6.1	8.6
	13+ years school attendance	2.4	3.4
RELIGIOUS DENOMINATION	Both spouses members of the Norwegian Church	92.2	94.7
	Both spouses members of another religious society	1.6	2.2
	None of the spouses members of a religious society	0.5	2.0
	All other combinations	5.7	1.1

[1]) Living in a first never broken marriage at second birth and 5 years afterwards

[2]) When calculating these percentages women for whom we only know year of marriage are excluded (4119 (27.4 per cent) among those with a second birth in 1969 and 30 (0.2 per cent) among those with a second birth in 1979)

Table 2.2 Per cent distribution of employed married[1]) women over the categories

		Second birth 1969	Second birth 1979
WOMAN'S AGE	20-22	11.9	6.3
	23-25	31.3	22.9
	26-28	31.1	33.5
	29-31	17.9	24.4
	32-34	7.8	12.9
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	19.1	12.5
	Husband 3-5 ys. older	28.5	30.0
	Husband 0-2 ys. older	40.4	45.2
	Woman older	12.0	12.3
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	32.9	12.3
	24-47 months	45.7	49.2
	48+ months	21.4	38.5
WOMAN'S EDUCATION	7- 9 ys. school attendance	36.5	23.9
	10 ys. school attendance	22.7	30.1
	11-12 ys. school attendance	15.3	13.5
	13-14 ys. school attendance	19.4	20.8
	15+ ys. school attendance	6.1	11.7
HUSBAND'S EDUCATION	7- 9 ys. school attendance	39.5	27.1
	10 ys. school attendance	19.3	19.4
	11-12 ys. school attendance	14.9	20.2
	13-14 ys. school attendance	13.2	13.8
	15-16 ys. school attendance	5.0	9.1
	17+ ys. school attendance	8.1	10.4
WOMAN'S LAB. FORCE PARTICIP.	100-999 hours	55.9	71.3
	1000+ hours	44.1	28.7
WOMAN'S OCCUPATION	Technical, scientific work	2.9	5.1
	Medical work	13.6	24.1
	Pedagogical work	20.4	16.0
	Clerical work	18.5	18.4
	Sales work, commerce	7.0	5.3
	Agriculture	14.1	5.2
	Industry, craft	5.5	4.1
	Hotel, restaurant, charwork	8.9	11.8
	Other occupations	9.1	10.0
HUSBAND'S OCCUPATION	Technical, scientific work	8.0	12.4
	Medical work	2.3	3.2
	Pedagogical work	13.3	11.6
	Administration	4.4	7.2
	Clerical work	5.7	4.8
	Sales work, commerce	8.5	7.8
	Agriculture	6.7	6.8
	Transport, communications	13.7	7.8
	Industry, craft	28.5	28.0
	Other occupations	8.9	10.4

cont.

Table 2.2 cont.

		Second birth 1969	Second birth 1979
WOMAN'S INCOME	0	27.2	4.1
	Low	27.5	22.4
	Medium	18.6	49.2
	High	26.7	24.3
HUSBAND'S RELATIVE INCOME	-0.75	21.4	15.3
	0.76-0.90	17.0	22.1
	0.91-1.00	16.2	20.9
	1.01-1.10	14.7	16.1
	1.11-1.25	15.3	12.3
	1.25+	15.4	13.3
PLACE OF RESIDENCE	East, non-rural	35.3	35.0
	East, rural	11.3	9.9
	South and West, non-rural	18.9	22.3
	South and West, rural	11.1	10.1
	Middle and North, non-rural	14.9	15.8
	Middle and North, rural	8.5	6.9
PARENTS' EDUCATION	Not living with parents, or education unknown	12.1	0.1
	7- 9 years school attendance	75.0	84.2
	10-12 years school attendance	8.6	10.5
	13+ years school attendance	4.3	5.2
RELIGIOUS DENOMINATION	Both spouses members of the Norwegian Church	90.5	83.3
	Both spouses members of another religious society	1.7	2.0
	None of the spouses members of a religious society	0.9	3.4
	All other combinations	6.9	11.3

[1]) See note table 2.1

3. METHODS

3.1 Methodological framework

In a study of parity progressions two approaches stand out as particularly relevant. The usefulness of hazard models for such analysis has been repeatedly demonstrated during the 1980s, and previous examinations of Norwegian fertility have been based on this technique (Kravdal and Brunborg, 1988; de Leon et al., 1988). Hazard models allow for inspection of simultaneous effects of several constant or time-varying background factors, and are well suited to handle the problem of censoring.

An alternative approach is to model the transition probabilities rather than the intensities, as is done with hazard models. Since we have a very large data set at our disposal, we have the opportunity to focus on women who had their second child in a single year (e.g. 1979) and observe their subsequent fertility behaviour. Censoring poses no problem. The few women who die or emigrate during the interval under study, which is usually taken to be 5 or 10 years from the second birth, can be excluded without biasing the estimates and without throwing away too much valuable information. The parity of the remaining women can be measured at the end of the interval, and the progression probabilities can be modelled by logistic regression.

This second methodology is chosen in the present analysis for purely practical reasons. Using only one fairly simple SAS-program (Statistical Analysis System), we are able to calculate frequency tables and mean values and estimate logistic regression models. Certainly, a detailed picture of fertility by duration since second birth is not obtained without modelling separately the progression probabilities within 1 year, 2 years, 3 years etc., but we believe that this does not outweigh the practical advantages of the logistic model as opposed to the hazard model.

3.2 More details about probability estimates

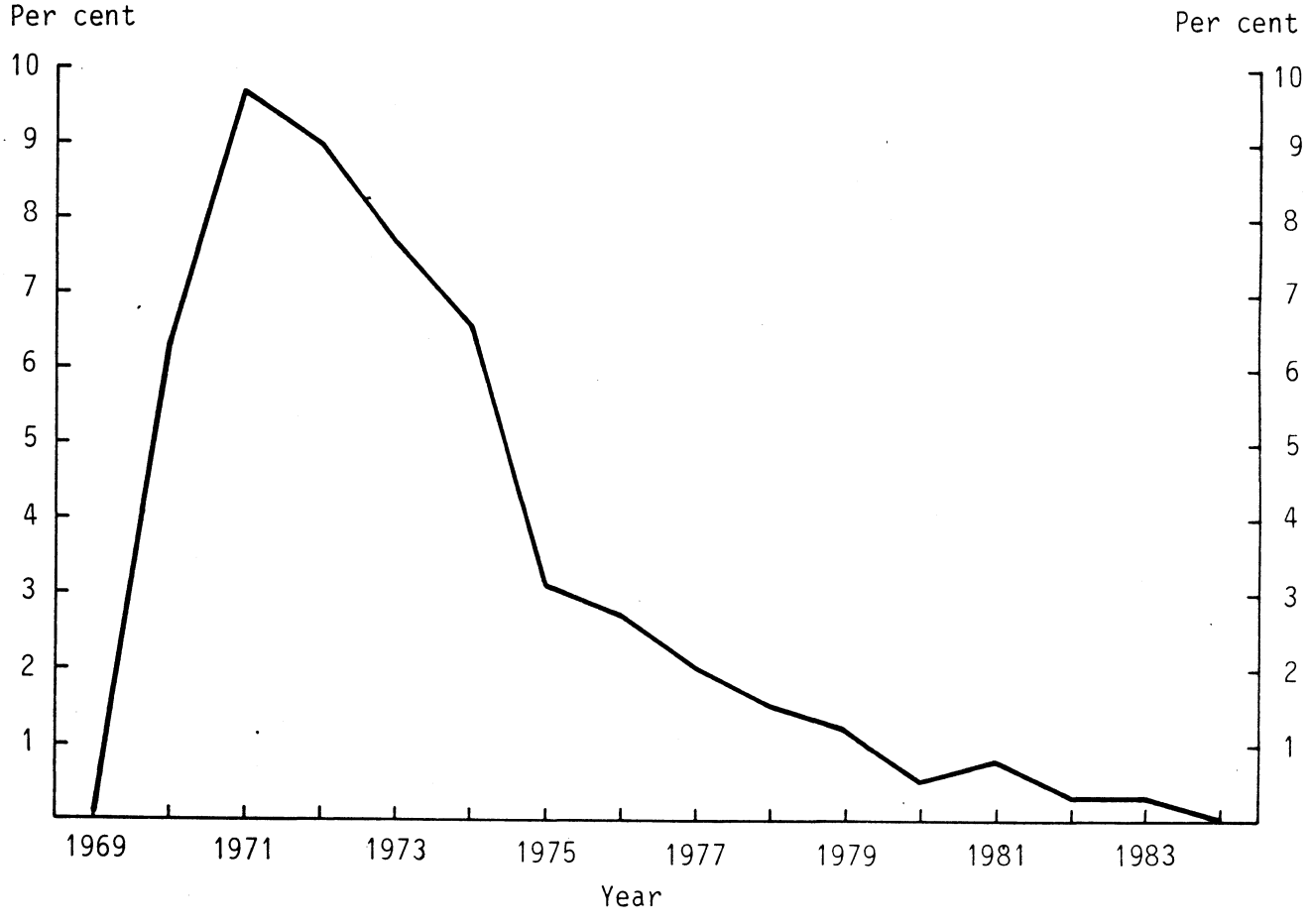
Only women who lived in Norway at the end of 1984 and at the time of the censuses 1960, 1970 and 1980 are included in the analysis. Moreover, third birth probabilities are, of course, not estimated for women who had their second and third child as twins.

Apparently, the exclusion of emigrants, immigrants and women who have died does not bias the results. Let us, for instance, focus on the 2113 women who had their second child in 1969 and who were 25 years old at that time (and who satisfy the inclusion criteria referred above). The proportions of these women who had their third child in 1969, 1970, 1971 etc. are displayed in figure 3.1. 39.3 per cent had their third child before the end of 1974. This corresponds to about 5.5 years duration, since second births are evenly distributed over the year 1969.

This proportion can be compared with that obtained from partial progression probabilities obtained in a life table framework. The most advanced method is to include all women from the time of second birth, unless it is known that they have immigrated at a later stage (can only be inferred for those who live in Norway at the end of 1984). The immigrants are included from time of

immigration. Those who have died or emigrated after the second birth (and before the end of 1984, of course) contribute to the exposure time from the second birth and up to the third birth or the time of death or emigration. The other women are censored at third birth or at the end of 1984. Intensities are assumed to be constant within one-year intervals. The results are plotted in figure 3.2. Summation over the first 5.5 years gives a partial progression probability of 39.4 per cent.

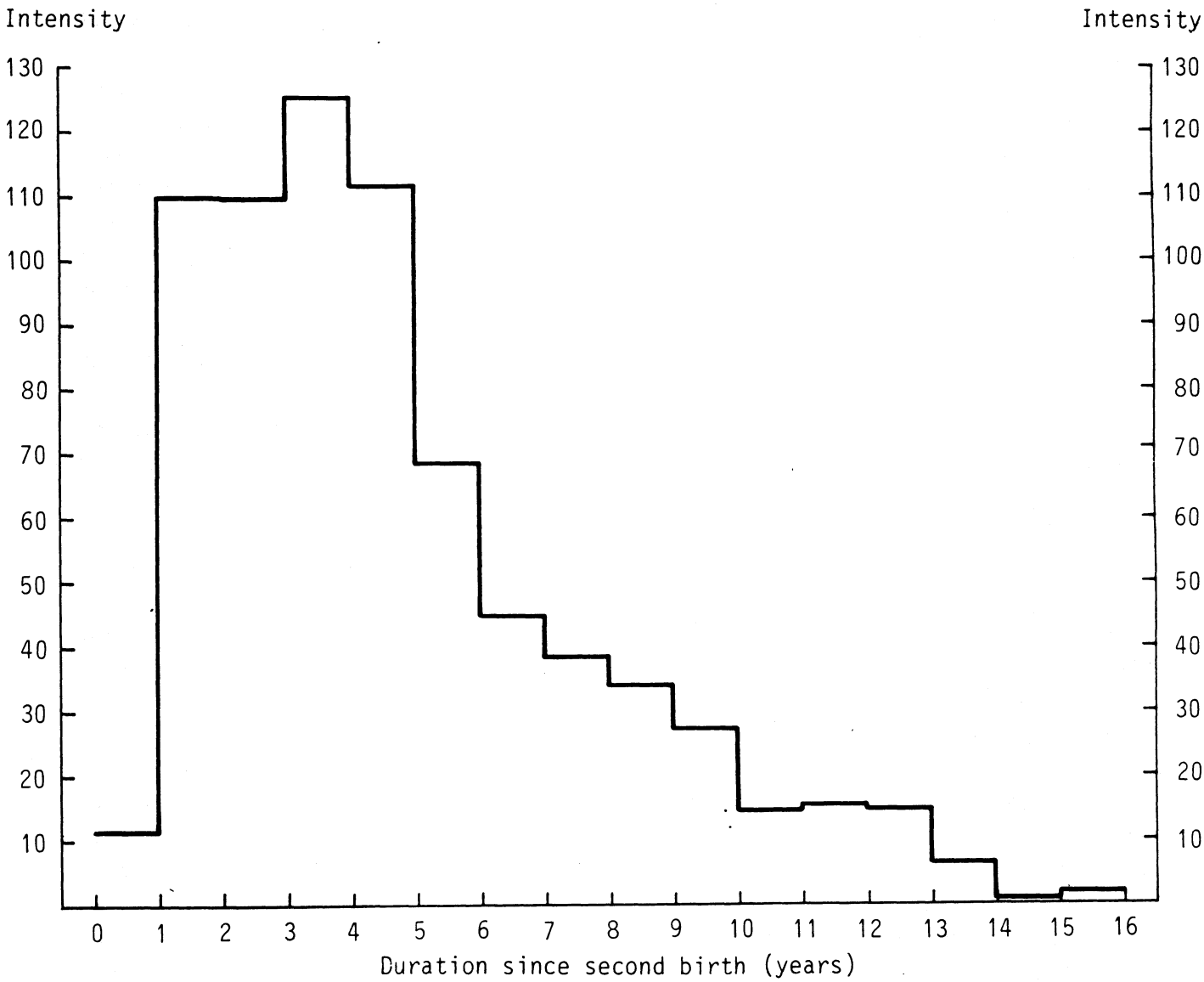
Figure 3.1 Proportions having a third birth during a given year for women who were 25 years at second birth in 1969. Per cent



Intensities are also estimated with the same inclusion criteria as used for the probabilities plotted in figure 3.1. In this case the women contribute to the exposure time from the second birth and up to the third birth or the end of 1984. The partial probabilities are 39.1 per cent.

These calculations indicate that immigrants and emigrants can safely be excluded, and that the probabilities obtained by simple division are, as expected, virtually identical to those obtained in a life table approach. The conclusion is supported by experiments with several combinations of year at second birth, age at second birth and duration since second birth.

Figure 3.2 Third birth intensities for women who were 25 years at second birth in 1969. Per 1000 per year



3.3 Logistic regression of third birth probabilities

The logistic model is of the form

$$\log (p/(1-p)) = Y \cdot B$$

or alternatively

$$p = 1 / (1 + \exp (- Y \cdot B)),$$

where p is the third birth probability, Y is a covariate vector and B is an effect vector. Maximum likelihood estimates of B are obtained by PROC LOGIST in the SAS-system. This routine is based on a Newton-Raphson algorithm.

As mentioned in the previous chapters, the regression models are confined to women living in a first never broken marriage (at second birth as well as at the end of the interval under study, which is 5 or 10 years). This implies that we estimate, for instance, the probability that a woman who is living in first marriage at second birth has a third birth within 5 years given that she has not had a break-up during those years .

The final model specifications reported in the tables in chapter 5 are based on categorical covariates. One of the categories is arbitrarily chosen as a baseline group. For instance, an estimate of 0.4 for the rural areas of Middle and Northern Norway means that the log(p/(1-p)) in this area is 0.4 greater (with fixed values of the other covariates) than the log(p/(1-p)) in the rural areas of Eastern Norway, which is the baseline group. If the probability in the baseline group is predicted to be 25 per cent (with a given set of other covariate values), an increase of 0.4 corresponds to a probability of 33.2 per cent, which is less than 40 per cent increase in the probability (33.2/25=1.33).

Table 3.1 gives the relation between the difference in the parameter estimates in the logistic regression models and the corresponding difference in probability. The relation depends, of course, on the baseline probabilities. 25 and 50 per cent are selected as examples.

Only positive parameters are displayed in the table. With negative parameters the ratio between the actual probability and the baseline probability is approximately the inverse of what we get with positive parameters of the same absolute value. (The deviation from the inverse increases as the parameters increase in absolute value).

An important aspect of the analysis is to assess whether the difference in fertility between a certain category and the baseline category is significant. This is easily done by inspection of the standard errors of an estimator. Roughly, the significance level is lower than 0.05 if the parameter estimate is more than the double of the estimated standard error. If we state that an effect is significant, it means that the parameter estimate is significantly different from 0 on a 0.05 level, or, more precisely, that the likelihood of obtaining an estimate at least as large as that observed (in absolute value) if the real parameter is 0, is smaller than 0.05. Occasionally, we also use the term "non-significant positive (or negative) effect" for simplicity, which means that the parameter estimate is positive (or negative), but not significantly different from 0.

All variables mentioned in chapter 2 are included in our regression models (tables 5.1-5.3, 5.6-5.10) except marital status, since we focus on the married women exclusively, and the timing of first birth relative to marriage. The latter is left out because the exact timing of marriage was unknown for as much as 27 per cent of the women having a second birth in 1969. Instead, we measure the effect of first birth timing in separate models where women for whom we only know the year of marriage are excluded.

Within the logistic regression framework it is fairly easy to estimate interaction effects between two variables (so-called first order interactions) or, in principle, between more variables. The importance of the interactions can be assessed by likelihood ratio tests, where the likelihood (-2 log L) of a model without interactions is compared to the likelihood of a model including one or more interactions.

Table 3.1 Third birth probability for a category with a parameter effect x estimated in a logistic regression model, if the third birth probability for the baseline category is 0.25 or 0.50[1])

Parameter effect x	Third birth probability for baseline group 0.25		Third birth probability for baseline group 0.50	
	Third birth probability	Third birth probability relative to baseline group	Third birth probability	Third birth probability relative to baseline group
0	0.250	1.000	0.500	1.000
0.05	0.259	1.038	0.513	1.025
0.1	0.269	1.077	0.525	1.050
0.2	0.289	1.157	0.550	1.100
0.3	0.310	1.241	0.574	1.149
0.4	0.332	1.329	0.599	1.197
0.5	0.355	1.419	0.622	1.245
0.6	0.378	1.511	0.646	1.291
0.7	0.402	1.607	0.668	1.336
0.8	0.426	1.704	0.690	1.380
0.9	0.451	1.802	0.711	1.422
1.0	0.475	1.901	0.731	1.462
1.5	0.599	2.396	0.818	1.635
2.0	0.711	2.845	0.881	1.762

[1]) Assuming the other covariate values are given by Y, the third birth probability for the baseline group is $P_0 = 1/(1+\exp(-YB))$ or $\ln(P_0/(1-P_0)) = YB$, where B is an effect vector. For another category with parameter effect x the third birth probability P_X is $P_X = 1/(1+\exp(-YB-X)) = 1/(1+(1-P_0)\exp(-X)/P_0)$. If $P_0 = 0.25$, $P_X = 1/(1+3\exp(-X))$. If $P_0 = 0.50$, $P_X = 1/(1+\exp(-X))$.

We also mention that women who have had a third child during the year after the second birth (1970 or 1980) are excluded from the regression analysis (about 1000 among the 16000 having a second birth in 1969, and about 200 among the 14000 having a second birth in 1979). This was done in order to obtain more relevant estimates of the effect of labour force participation one year after second birth, which is a variable that is likely to be strongly influenced by fertility itself. We feared that if all women were included, the 5- or 10- year birth probabilities would be systematically higher for not employed women, as many of them are homemakers just because they have recently had their third child (i.e., during 1969-1970 or 1979-1980). However, all parameters - also those associated with labour force participation - are virtually insensitive to the omission of women with third births during 1969-1970 or 1979-1980. This is shown in table 3.2 for women having a second birth in 1969. The changes in the parameters are even smaller for those with a second birth in 1979.

In addition, we have estimated a set of models for women having their second births in 1968 or 1978 in order to see the effect of labour force participation two years after birth (when participation rates are higher). These results are briefly referred to in chapter 5.

Table 3.2 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 5 years after the second. Married women[1])

		Second birth 1969 Women with a third birth 1969-1970 not excluded		Second birth 1969 Women with a third birth 1969-1970 excluded	
WOMAN'S AGE	20-22	0.09	(0.05)	0.06	(0.05)
	* 23-25	0		0	
	26-28	-0.07	(0.05)	-0.07	(0.05)
	29-31	-0.27	(0.06)	-0.26	(0.06)
	32-34	-0.61	(0.09)	-0.66	(0.09)
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	0.04	(0.05)	0.03	(0.05)
	* Husband 3-5 ys. older	0		0	
	Husband 0-2 ys. older	0.05	(0.04)	0.05	(0.04)
	Woman older	0.28	(0.06)	0.25	(0.07)
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	0.52	(0.04)	0.49	(0.04)
	* 24-47 months	0		0	
	48+ months	-0.44	(0.05)	-0.50	(0.06)
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	-0.18	(0.04)	-0.17	(0.05)
	11-12 ys. school attendance	0.19	(0.06)	0.17	(0.07)
	13-14 ys. school attendance	0.32	(0.08)	0.31	(0.08)
	15+ ys. school attendance	0.52	(0.15)	0.45	(0.16)
HUSBAND'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10-12 ys. school attendance	-0.14	(0.04)	-0.14	(0.04)
	13+ ys. school attendance	-0.07	(0.08)	-0.06	(0.08)
WOMAN'S LAB. FORCE PARTICIP.	* Not employed (less than 100h)	0		0	
	100-999 hours	-0.07	(0.06)	-0.02	(0.06)
	1000+ hours	-0.24	(0.07)	-0.17	(0.07)
HUSBAND'S OCCUPATION	Technical, scientific work	0.01	(0.08)	-0.01	(0.09)
	Medical work	0.18	(0.16)	0.14	(0.16)
	Pedagogical work	0.02	(0.10)	0.00	(0.11)
	Administration	0.05	(0.10)	0.08	(0.10)
	Clerical work	-0.16	(0.08)	-0.14	(0.08)
	Sales work, commerce	-0.19	(0.07)	-0.20	(0.07)
	Agriculture	0.45	(0.07)	0.38	(0.08)
	Transport, communications	-0.04	(0.06)	-0.07	(0.06)
	* Industry, craft	0		0	
	Hotel, restaurant, charwork	-0.05	(0.14)	-0.05	(0.14)
	Other occupations	0.01	(0.07)	0.02	(0.08)
HUSBAND'S RELATIVE INCOME	-0.75	0.19	(0.05)	0.15	(0.05)
	* 0.76-1.25	0		0	
	1.25+	-0.03	(0.05)	-0.02	(0.05)

cont.

Table 3.2 cont.

		Second birth 1969 Women with a third birth 1969-1970 not excluded	Second birth 1969 Women with a third birth 1969-1970 excluded
PLACE OF RESIDENCE	East, non-rural	-0.28 (0.06)	-0.24 (0.06)
	* East, rural	0	0
	South and West, non-rural	0.24 (0.06)	0.26 (0.06)
	South and West, rural	0.73 (0.07)	0.71 (0.07)
	Middle and North, non-rural	0.04 (0.07)	0.04 (0.07)
	Middle and North, rural	0.43 (0.08)	0.41 (0.08)
CONSTANT TERM		-0.55 (0.07)	-0.71 (0.07)

* Baseline group
[1]) Living in a first never broken marriage at second birth and 5 years afterwards

Multicolinearity appears to be no problem, which one might fear, as the woman's education, the husband's education and the husband's income are included in the models. We have experimented with a variety of models with only a subset of the variables included, and find a fairly large stability in the parameters.

3.4 Other regression models

Logistic regression is also used to study some determinants of female labour force participation. Besides, expected income for husbands is predicted on the basis of parameters estimated in a linear regression model of actual income. In this model the age of the husband (as a second degree polynomial), his educational level and his occupation are used as independent variables.

4. THIRD BIRTH PROBABILITIES BY AGE, MARITAL STATUS, PLACE OF RESIDENCE AND EDUCATIONAL LEVEL

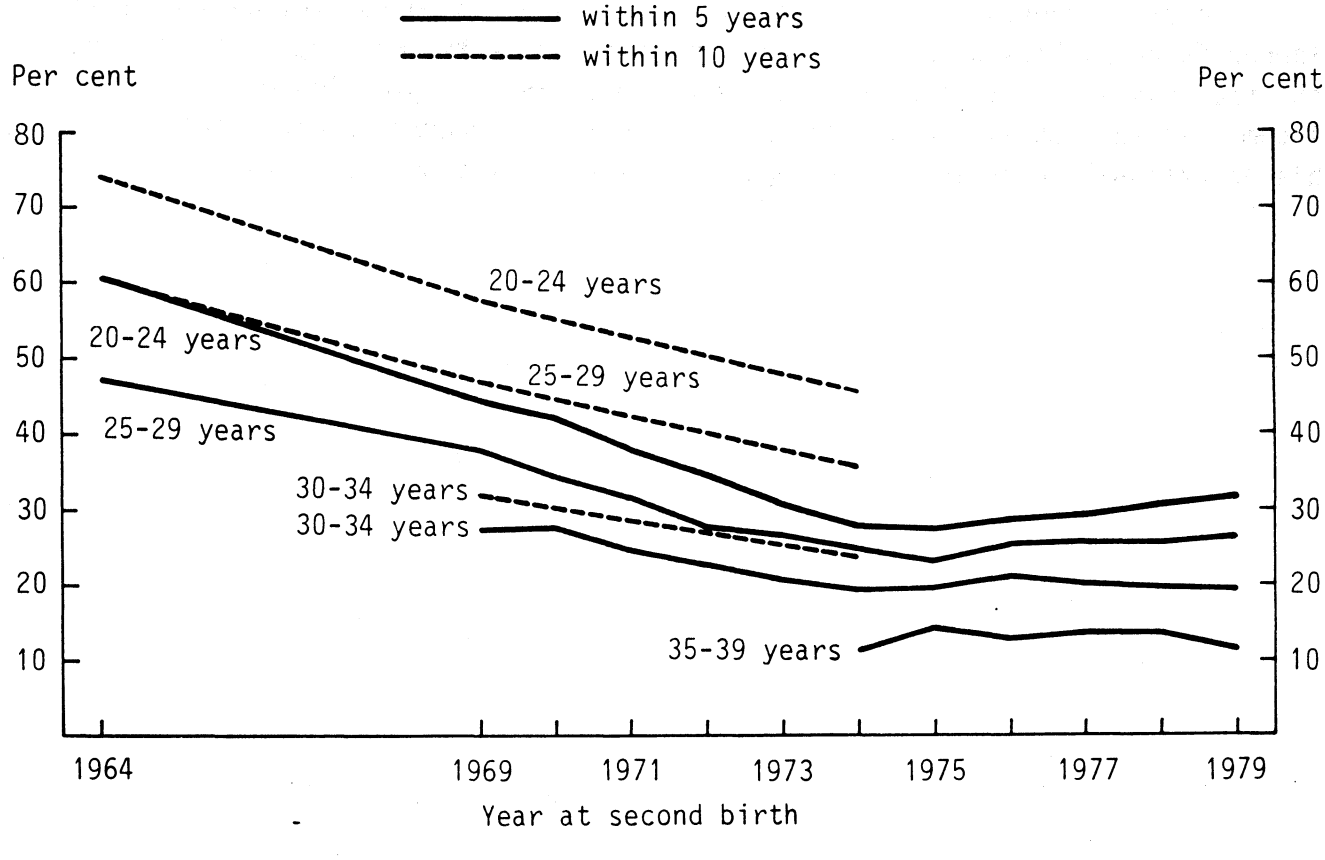
This chapter is devoted to a simple description of trends and variations in third birth probabilities from the mid-1960s to the mid-1980s. The results are derived from calculations for separate groups of women, but references to regression model estimates are occasionally made. A theoretical discussion of the regional and educational fertility differences as well as the effect of age on fertility is left to chapter 5.

4.1 Third birth probabilities by age

Third birth probabilities for 5-year age groups are plotted in figure 4.1. As demonstrated by Kravdal and Brunborg (1988) a decline appears from the mid-1960s to the mid-1970s. For instance, among women who had their second birth at age 25-29 years in 1964, 47 per cent had a third birth within 5 years and 61 per cent within 10 years. A decade later the corresponding figures were 25 per cent and 35 per cent, respectively.

It is interesting to note that the 5-year probabilities level off, or even start climbing. For the age group 25-29 years they remain virtually constant at 25-26 per cent from 1975 to 1979, and for the age group 20-24 there is an upturn from 28 to 32 per cent during that period.

Figure 4.1 Probability of having a third birth within 5 or 10 years after the second, by age and year at second birth. Per cent



The women younger than 25 at second birth have gradually become a more select group, and that may account for a part of the recent parity progression increase for this age group. In 1969 as much as 46 per cent of all women who were 20-34 years at second birth were also younger than 25. This proportion fell to 36 per cent in 1974 and 30 per cent in 1979. Nevertheless, the increase in the 5- year probability signals that crucial changes in the reproductive behaviour of Norwegian two-child mothers may be in the offing.

Obviously, the third birth trends deserve future scrutiny. A study of male fertility indicates that the 5-year probabilities have remained constant or increased slightly also during 1985 and 1986 (deLeon et al., 1988) . Whether the 10-year probabilities follow the same pattern remains to be seen. At present we cannot rule out the idea that the trends depicted in figure 4.1 represent primarily a change in the spacing pattern. Perhaps a larger proportion of women who eventually give birth to a third child, prefer to do so within the first five years after they have delivered their second child.

4.2 Marital break-up an obstacle to third births?

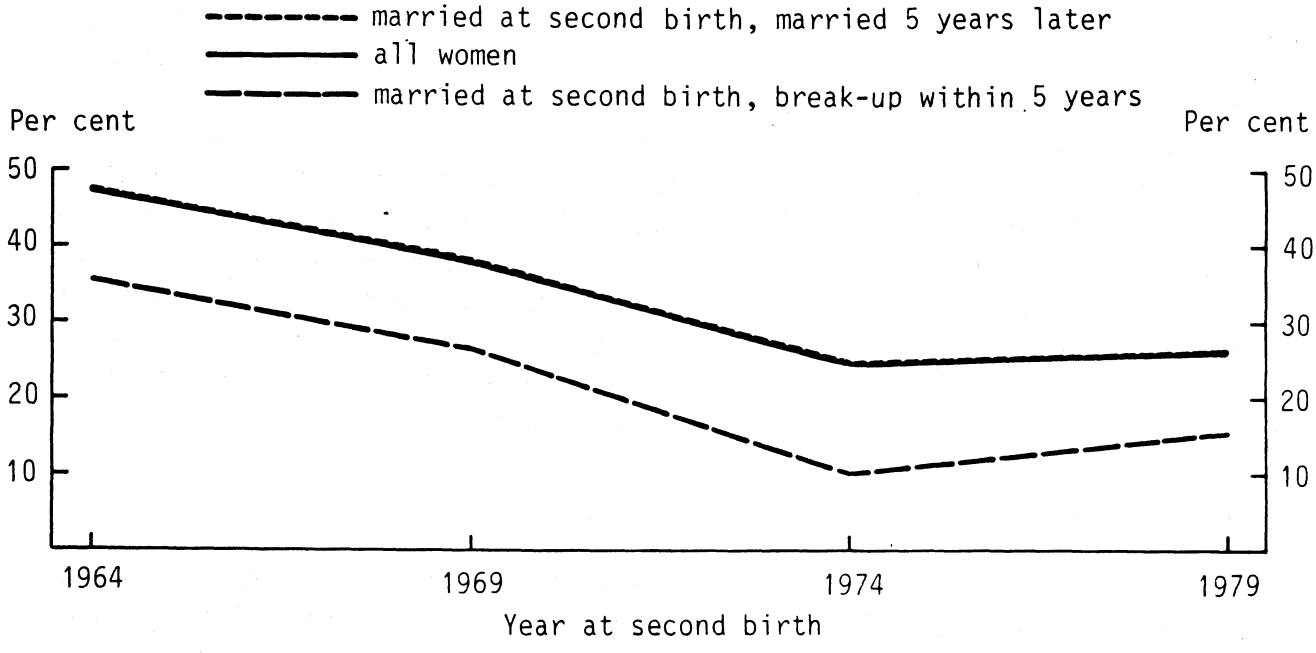
A very large proportion of the women who have their second child are married at the time of delivery as well as 5 or 10 years later. Among women having their second child at age 25-29 years in 1979, 87 per cent lived in first marriage both at that time and 5 years later. 5 per cent lived in first marriage at the time of delivery, but had divorced, separated or become widows within the subsequent 5 years. Most of the remaining women lived in a second marriage at second birth as well as 5 years later. For women with a second birth at age 25-29 in 1969 the corresponding proportions were 93 and 4 per cent, respectively.

The third birth probabilities for women who lived in first marriage during the entire 5-year interval, and for those who have experienced a break-up are plotted in figure 4.2. As expected, the women in stable marriages have probabilities close to those found for the total group of women of the same age. The few women who dissolve their marriage after the second birth have considerably lower progression probabilities. This is consistent with previous studies showing that, as one would expect, women who have divorced, separated or become widows exhibit a lower cohort fertility than those who have lived in stable unions (Kravdal, 1989). For instance, it was found that a break-up reduces the total cohort fertility by about 0.2 for women born in 1945.

The same pattern emerges when we consider the 10-year probabilities. As indicated in table 4.1 women who have experienced a permanent or temporary break-up - which is, of course, a larger group when the observation interval is extended from 5 to 10 years - more often tend to stop childbearing after second delivery than those living in stable marriages.

With only a few exceptions the women in second marriage appear to have third birth probabilities somewhat higher than average. This agrees well with previous findings from Norway. Brunborg and Kravdal (1986) estimated that, at a fixed age at second birth and interval between first and second birth, the women who had changed partner between first and second birth had higher third birth intensities. A Swedish analysis also suggests a positive effect of a new union formation (Hoem and Hoem, 1989).

Figure 4.2 Probability of having a third birth within 5 years after the second for women who were 25-29 years at second birth, by marital status. Per cent



In the youngest age groups a few women were never married at second birth. The highest figures are observed for women aged 20-24 who gave birth in 1974. About 5 per cent were never married (and probably lived in consensual unions), but half of them married during the subsequent 5-year period. Among those who married, the third birth probability was 41 per cent, which is higher than for any other marital status group. For those who remained unmarried, however, the probability was only 23 per cent, which is almost as low as for those who had a marital break-up during the 5-year period.

4.3 Regional differentials in the third birth probabilities

For births in 1969 or 1979 the place of residence refers to the situation one year afterwards, and for births in 1964 and 1974 it refers to the situation 6 years afterwards. A similar problem exists with respect to education and is dealt with in section 4.4.5. In principle, a bias may be introduced in the estimated relation between place of residence and fertility among women having their second child in 1964 or 1974. However, there is probably little change in the distribution over the regions for the population under study during the actual 5-year period (see table 8.6 in Kravdal, 1989), so by and large the positive and negative biases cancel each other.

For instance, some couples have moved from non-rural areas of Eastern Norway to rural areas of Southern Norway between 1965 and 1970. With our procedure their fertility contributes to that of the latter region, while in the ideal approach it should have contributed to that of the former region. If these couples have a fertility intermediate to that of the couples living in the rural areas of Southern Norway and that of the couples living in the non-rural areas of Eastern Norway, we introduce a negative bias of the estimates in both regions. If, instead, the couple had moved in the opposite direction, there

Table 4.1 Probability of having a third child within 5 or 10 years after the second[1]), by marital status and age and year at second birth. Per cent

Year at second birth	Age at second birth	5-year probability			10-year probability		
		Living in first marriage at second birth and 5 years later	Living in first marriage at second birth, but not 5 years later	Experienced break-up before second birth[2])	Living in first marriage at second birth and 10 years later	Living in first marriage at second birth, but not 10 years later	Experienced break-up before second birth[2])
1964	20-24	61.2	48.1	46.8	74.9	66.9	67.0
	25-29	47.4	35.6	40.3	61.0	55.6	55.8
1969	20-24	45.3	33.6	42.1	58.9	50.3	57.0
	25-29	38.3	26.6	41.9	47.7	38.9	50.3
	30-34	27.4	13.9	33.7	31.9	26.6	43.0
1974	20-24	27.9	23.4	32.9	46.1	39.7	51.7
	25-29	25.1	10.2	28.3	36.3	24.2	37.8
	30-34	18.6	10.5	30.1	23.5	18.7	33.3
	35-39	11.6	-	9.5	12.0	6.5	9.5
1979	20-24	32.7	20.3	39.2			
	25-29	26.4	15.3	30.2			
	30-34	19.1	6.4	23.6			
	35-39	11.6	-	13.1			

[1]) The few women who were never married at second birth are not included in the tables
[2]) Most of them remarried
\- Probability not calculated for groups smaller than 25

would have been a positive bias. If the two migration streams were equal, the positive and negative biases would outweigh each other.

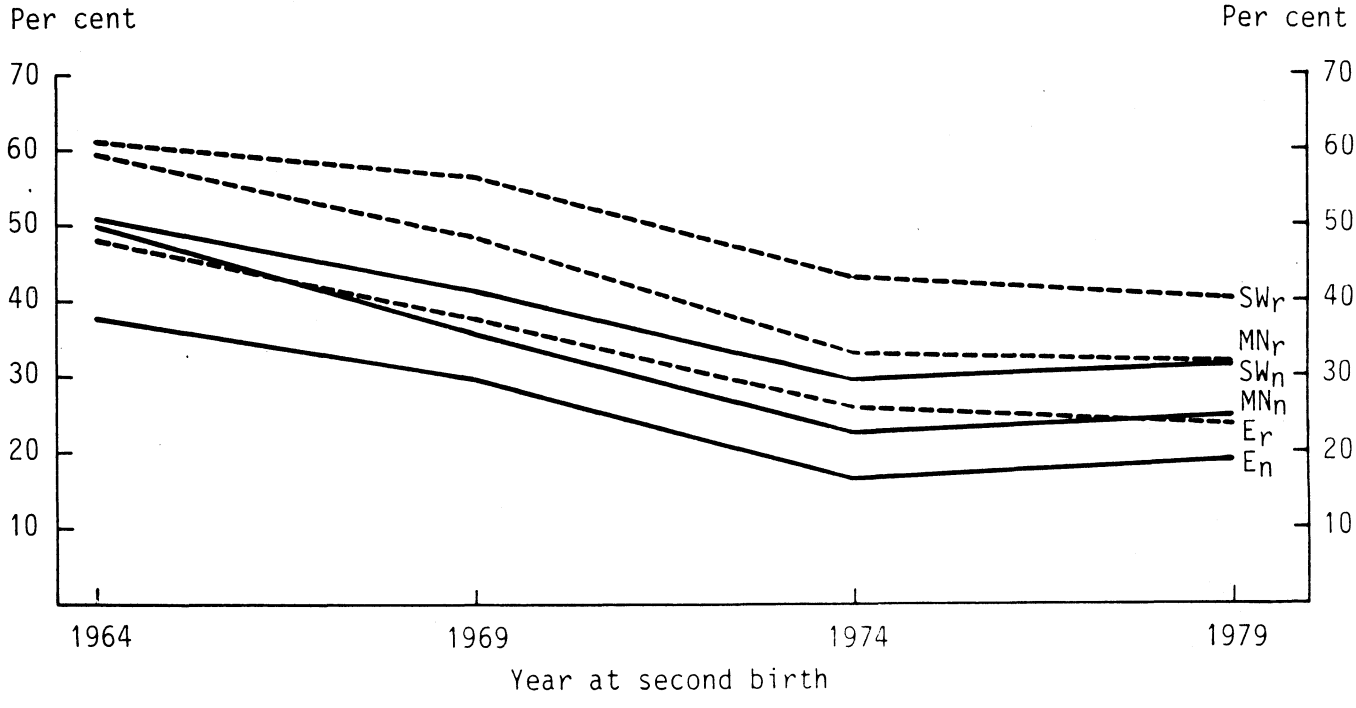
The large regional differences that are found in total cohort fertility (Kravdal, 1989) also show up when the focus is on progressions to parity 3. Third birth probabilities for 10 regions are given in tables 4.2-4.4, and the figures for some larger regions are plotted in figure 4.3.

The highest progression probabilities are found in Southern and Western Norway, and the lowest in Eastern Norway. Within each of the 3 main regions women living in rural areas have a larger third birth fertility than those living in non-rural areas.

Both 5- and 10-year probabilities show a marked downward trend from 1964 to 1974. The decline has been most pronounced for Middle and Northern Norway, which is also found for total cohort fertility. After 1974 the change in the 5-year probabilities has been very moderate. For the age group 25-29 years a slight decrease can be discerned in the rural areas (1.1 - 2.9 per cent), and an increase in the non-rural areas (1.9 - 2.6 per cent). This has led to a certain narrowing of the rural/non-rural differentials during the late 1970s and early 1980s, while the differences between the main regions have remained

unchanged. The picture is more diverse for the other age groups. Among women who had a second birth at age 20-24 there has been an increase in the third birth probabilities in all regions except Northern Norway and the rural areas of Southern Norway. The latter region had by far the highest probability in 1974. For the age group 30-34 some regions have experienced a decline, others a moderate increase.

Figure 4.3 Probability of having a third birth within 5 years after the second for women who were 25-29 years at second birth, by place of residence [1]. Per cent



1) Eastern Norway: E_n (non-rural) and E_r (rural)
Southern and Western Norway: SW_n (non-rural) and SW_r (rural)
Middle and Northern Norway: MN_n (non-rural and MN_r (rural)

4.4 The relation between education and third birth probabilities

4.4.1 Gross and net effects. Methodological considerations

The effect of education on the total life-time fertility works to a large extent through age at first birth or first marriage (Rindfuss et al., 1980). This has also been confirmed in Norway, where very small educational differences in total cohort fertility were found when the age at marriage was controlled (Kravdal, 1989). In fact, for the 1935 cohort the sign of the education effect was reversed from negative to postive when this variable was included in the regression model.

Apparently, age is also a crucial factor when the relation between education

and third birth probabilities is discussed. A higher education goes along with a later entry into motherhood, and consequently a higher age at second birth, which in turn is associated with lower third birth probabilities. Age seems to be less important when interpreting most of the other fertility determinants considered in this analysis. Therefore, we exhibit simple cross-tabulations of third birth probabilities by educational level, as well as tabulations for each age group separately.

Some comments on the underlying behavioural mechanisms are pertinent at this stage: Above all, we want to stress that a model where education has a direct effect on third births (or mediated by variables other than age) and an indirect effect through age is a clear over-simplification. There may be common factors affecting both the age and the third birth probabilities and even the educational level attained. Moreover, expectations about fertility may have an effect on the enrollment strategies and the educational aims. We do not intend to go into detail with the most complex models, but merely point out the estimation problem we are faced with if familism, contraceptive use and other unobserved factors influence both age at second birth and the third birth probabilities.

The standard multivarate regression models are based on the assumption that the regressors are uncorrelated with the error term of the dependent variable. Let us, for simplicity, focus on a linear regression model where education (E) and age at second birth (A) are the regressors and the additional children expected (Y) is the dependent variable, i.e. $Y=\alpha+\beta A+\gamma E+\varepsilon$, where ε is the error

Table 4.2 Probability of having a third birth within 5 or 10 years after the second for women who were 25-29 years at second birth, by place of residence. Per cent

Place of residence		5-year probability				10-year probability		
		second birth 1964	second birth 1969	second birth 1974	second birth 1979	second birth 1964	second birth 1969	second birth 1974
Eastern Norway	non-rural	37.8	29.7	16.3	18.9	49.5	36.9	24.7
	rural	48.1	37.6	25.8	23.6	60.3	45.7	34.9
Southern Norway	non-rural	49.0	41.7	31.7	32.5	64.5	53.4	44.0
	rural	60.2	59.2	45.0	44.7	79.2	68.6	59.6
Western Norway	non-rural	52.6	41.0	27.5	30.3	66.6	51.5	40.1
	rural	61.7	55.3	42.2	37.7	77.1	66.9	57.4
Middle Norway	non-rural	48.0	35.4	22.5	24.3	61.3	42.9	31.6
	rural	56.8	47.0	32.4	32.4	74.6	58.6	48.7
Northern Norway	non-rural	51.2	35.9	22.4	25.5	67.5	46.8	33.3
	rural	61.3	50.0	33.5	31.5	72.2	62.9	49.7
Total		47.2	37.9	24.6	26.2	60.6	47.0	35.3

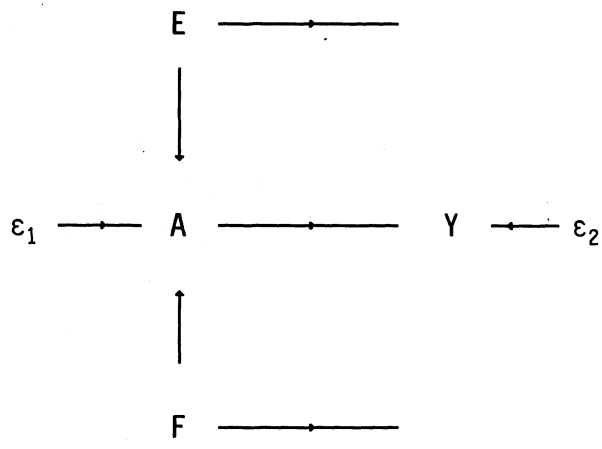
Table 4.3 Probability of having a third birth within 5 years after the second for women who were 20-24 years at second birth, by place of residence. Per cent

Place of residence		Second birth			
		1964	1969	1974	1979
Eastern Norway	non-rural	50.7	32.8	20.7	24.7
	rural	58.5	44.3	25.9	27.0
Southern Norway	non-rural	62.9	47.1	32.5	35.5
	rural	72.8	63.0	45.4	43.8
Western Norway	non-rural	63.8	46.7	28.6	31.9
	rural	74.7	62.7	35.2	44.8
Middle Norway	non-rural	58.2	38.5	21.5	29.0
	rural	68.9	54.9	33.5	37.0
Northern Norway	non-rural	62.9	45.8	28.6	28.4
	rural	69.6	59.4	36.4	36.3
Total		60.6	44.5	27.8	31.7

Table 4.4 Probability of having a third birth within 5 years after the second for women who were 30-34 years at second birth, by place of residence. Per cent

Place of residence		Second birth		
		1969	1974	1979
Eastern Norway	non-rural	20.0	13.2	14.1
	rural	32.7	20.4	21.8
Southern Norway	non-rural	28.7	26.3	22.5
	rural	42.9	28.4	33.8
Western Norway	non-rural	31.7	22.8	21.5
	rural	41.8	30.7	31.9
Middle Norway	non-rural	28.2	16.3	21.1
	rural	42.6	27.8	20.8
Northern Norway	non-rural	28.3	19.5	20.4
	rural	35.5	33.3	28.3
Total		27.3	19.1	19.2

term. Under the traditional assumption referred above, there is a simple estimator for γ having γ as expected value. However, if the real underlying process is like that sketched below,



(ε_1 and ε_2 uncorrelated)
(might alternatively have been specified as a prouss with ε_1 and ε_2 correlated and F neglected)

where family values, contraceptive use etc.(F) influence both age and fertility, that estimator is biased. Under rensonable assumptions about the signs of the effects, the expected value is larger than γ. The bias depends on the relative importance of F in determining A and Y, which we have very little knowledge about.

To illustrate the arguments above, we describe briefly the implications of fixing the age at a special value, which we do in section 4.4.4 and indirectly in the regression models in chapter 5: At a low age at second birth those with a high education, which is usually associated with a late start of family building, represent a select group of "family and reproduction oriented" couples. (To obtain a low A with a high E, F must typically have a value corresponding to an early start of childbearing). On the other hand, at a high age at second birth those with a low education may be less "family oriented" or may be selected for subfecundity. This contributes to a positive relation between education and third birth probabilities, and may give an exaggerated impression of the direct effects of the former variable on the latter.

4.4.2 The gross effect of education

The probabilities of having a third child within 5 years after the second are displayed in table 4.5 for all women born after 1935 (i.e., we do not use the age 20-34 restriction, and we do not group by age). For women with a second birth prior to 1974 there is an almost U-shaped association between education and fertility (or, more precisely, a mixture between a V and a constant). Only those with 10 years school attendance have progression probabilities significantly different (on a 0.05 level) from those of the women with no more than the compulsory education (significance tests not shown). For the 1975 parity cohort there is in addition a significant, but positive, effect of high education. During the remaining part of the 1970s the 5-year probabilities tend to increase with educational level: Women with 13 or more years of schooling have significantly higher third birth probabilities than those with only the compulsory education, and those with 10 years schooling have not significantly lower.

Table 4.5 Probability of having a third child within 5 years after the second for women born after 1935, by educational level and year at second birth. Per cent

EDUCATION (years of school attendance	YEAR AT SECOND BIRTH								
	1964	1969	1972	1974	1975	1976	1977	1978	1979
				N					
7- 9	54.5	41.1	31.2	25.6	9994	23.3	23.9	24.1	22.8	22.8
10	51.3	34.6	24.7	21.2	4963	21.8	23.4	24.0	25.5	26.3
11-12	56.4	40.5	30.7	26.8	2136	23.9	26.1	23.7	24.6	26.6
13-14	56.3	41.6	33.0	27.0	1581	29.1	31.5	30.5	30.8	30.8
15+	59.0	41.5	27.5	24.7	709	27.7	34.8	32.3	32.5	30.5
Total *)	54.2	39.7		24.7						25.8

N = Number of women (1974 arbitrarily chosen among the years to give an example of the sample sizes)

*) Not calculated for all years

With a 10-year observation interval the same U-shaped associations appear among women with second births during 1964-1974 (table 4.6). Unfortunately, women who deliver their second child after 1974 cannot be observed for such a long period of time. Therefore, we do not know for sure whether the positive education effect only reflects a tighter spacing among the highly educated, or if a larger proportion eventually have a third child.

Table 4.6 Probability of having a third child within 10 years after the second for women born after 1935, by educational level and year at second birth. Per cent

EDUCATION (years of school attendance	YEAR AT 2. BIRTH		
	1964	1969	1974
7- 9	68.2	52.0	38.2
10	64.6	44.7	32.7
11-12	67.6	50.4	37.4
13-14	71.3	51.8	38.7
15+	69.0	49.6	37.8

For the sub-population on which the regression analysis is based, those aged 20-34 at second birth and who were married at that time and 5 years later, we find, not surprisingly, almost the same third birth probabilities as reported in table 4.5 (table 4.7).

Table 4.7 Probability of having a third child within 5 years after the second, by educational level and year at second birth. Women who were 20-34 years old at second birth, and who lived in first marriage at that time and 5 years afterwards. Per cent

EDUCATION (years of school attendance	YEAR AT SECOND BIRTH 1964	1969	1974	1979
7- 9	54.0	41.3	25.3	22.1
10	51.6	35.0	21.8	27.1
11-12	57.4	40.8	27.8	28.0
13-14	56.9	42.0	28.7	33.0
15+	59.0	42.4	26.5	33.1

We note with interest that the positive education effect in Norway emerges during the same years as the general plateau in third birth progressions. In other words, the positive effect of high education, as well as the female "educational revolution", have provided an important contribution to the halting decline.

4.4.3 Third birth progressions and total cohort fertility

The empirical conclusion that higher education is positively related to third birth probabilities seems to go counter to most of the evidence previously reported with respect to total cohort fertility. In fact, research from Norway as well as from several other countries demonstrate very clearly that for women at a given age the total number of children is lower, the higher the educational level. For instance, Kravdal (1989) has found that among women born 1945, those who had only primary education had 2.4 children on average at age 39, while those who by age 35 had attained a level corresponding to at least a bachelor's degree had 1.8 children at age 39. A similar negative gradient is found for the 1935 and 1955 cohorts, and for several other cohorts, according to the 1977 Fertility Survey (Noack and Østby, 1981).

To discuss this apparent paradox we have tabulated a few fertility measures for the 1945 cohort (table 4.8). We note that childlessness is more prevalent among the high education groups - whatever the causal relation might be - so that there is a smaller group who reach parity two. In other words, the influence of education on total cohort fertility is not only restricted to third births. Given that the women have delivered their second child, there is still a negative effect of education on further reproduction. For instance, the proportion who eventually have a third child is 53 per cent among the women with only 7-9 years of school attendance, as opposed to 34 per cent among those with more than 15 years (weighted average). If we restrict ourselves to a 5-year interval, the corresponding proportions are 41 and 27 per cent, respectively. Several of the women in the high education group may have had their second child so late that 5 years are not elapsed by the end of 1984. Thus, a follow-up might reveal a less markedly negative gross effect of education, perhaps even a positive effect, though the latter is not very likely.

Table 4.8 Parity distribution and average number of children at age 39, proportion of two-child mothers eventually having a third child, and proportion of two-child mothers having a third child within 5 years after the second, among women born in 1945

EDUCATION (years of school attendance	PARITY DISTRIBUTION (per cent) 0	1	2	3+	AVERAGE NUMBER OF CHILDREN	PROPORTION OF TWO-CHILD MOTHERS WITH A THIRD CHILD (per cent)	PROPORTION OF TWO-CHILD MOTHERS WITH A THIRD CHILD WITHIN 5 YEARS (per cent)
7- 9	7.5	10.9	38.0	43.5	2.38	53.4	41.2
10	8.0	12.1	46.5	33.4	2.15	41.8	31.8
11-12	9.5	12.7	46.5	31.4	2.09	40.3	30.8
13-14	12.1	12.5	45.2	30.2	2.02	40.1	30.3
15-16	15.8	12.4	48.2	23.6	1.86	32.9	25.8
17+	25.3	11.6	40.1	23.0	1.64	36.4	30.4

To summarize, we have not seen clear signs of a positive education effect for the 1945 cohort. It is important to be aware, however, that the women with a second birth during 1975-1979, for whom there has been a positive effect of education on the 5-year probabilities, are recruited from several cohorts. The youngest are born in the 1950s, and these cohorts may exhibit different educational differentials in the final parity distribution when their fertile period is terminated.

We also point out that there are good principal reasons to expect some differences between a birth cohort and a parity cohort approach. Within a certain birth cohort those with a high education tend to have their second child at a later age than those with a low education, and consequently also at a later (historical) time. Thus, if fertility decreases, and primarily as a period phenomenon, there may be a more negative effect of education found with a birth cohort approach than with a parity cohort approach, where time at second birth is fixed.

4.4.4 The effect of education within each age group

When we fix the age, there is a clear positive relation between a high education and the third birth probabilities, even among women with a second birth prior to 1975 (table 4.9-4.11, and illustration in figure 4.4). The only exception are those aged 20-24 at second birth in the 1960s and early 1970s.

4.4.5 Data limitations

Unfortunately, the tabulated probabilities for the years 1964, 1969, 1974 and 1979 are not strictly comparable. For the years 1969 and 1979 the educational level refers to the situation one year after delivery (1970 and 1980, respectively). For the years 1964 and 1974, however, the census information (1970 and 1980, respectively) gives the level attained 6 years after delivery. This lack of continuous information is more severe for the educational

variable than for the regional variable, as only one direction of transitions is possible between educational levels.

The women who had only primary education (7-9 years school attendance) 6 years after second birth had, of course, a primary education also 5 years earlier. Also for most of those with a secondary education (10-12 years school

Table 4.9 Probability of having a third birth within 5 or 10 years after the second for women who were 25-29 years at second birth, by educational level. Per cent

Educational level	5-year probability				10-year probability		
	second birth 1964	second birth 1969	second birth 1974	second birth 1979	second birth 1964	second birth 1969	second birth 1974
7-9 years of school attendance	46.2	37.0	23.9	21.3	59.6	45.9	34.4
10 years of school attendance	42.6	33.3	20.8	25.0	56.5	41.6	30.3
11-12 years of school attendance	55.3	42.9	29.1	27.3	67.5	53.1	40.1
13-14 years of school attendance	55.9	45.3	29.8	34.4	70.5	57.0	43.2
15 or more years of school attendance	59.6	46.5	27.8	38.9	67.3	52.0	43.2

Table 4.10 Probability of having a third birth within 5 years after the second for women who were 20-24 years at second birth, by educational level[1]). Per cent

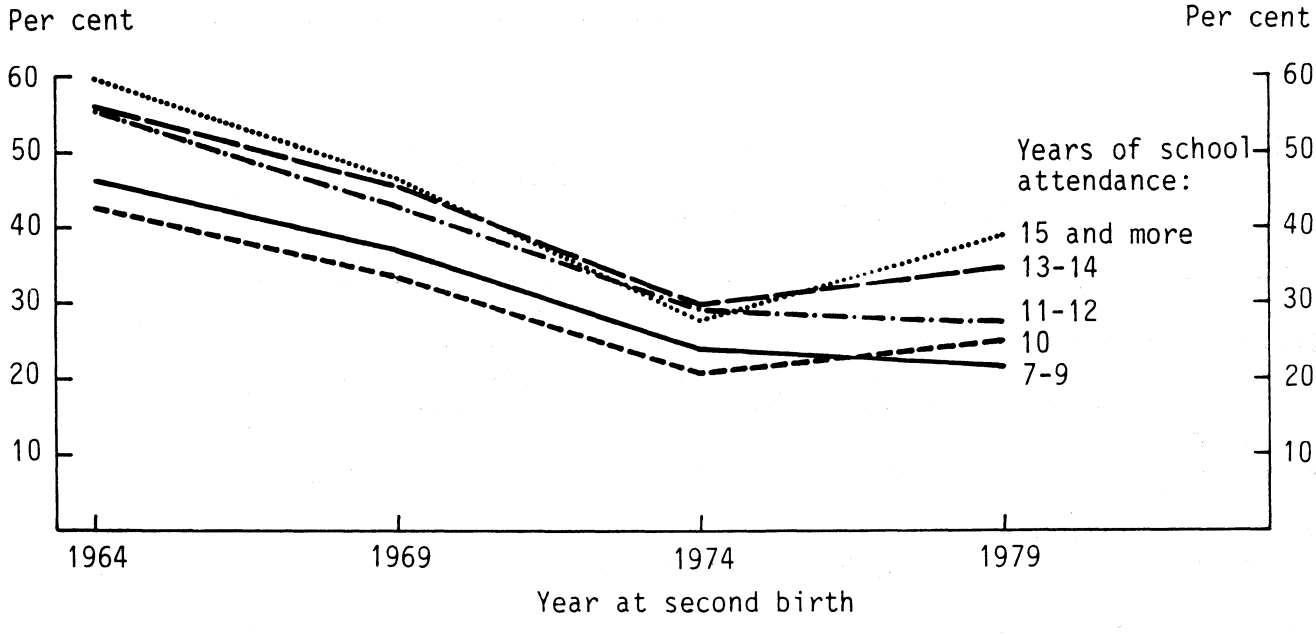
Educational level	Second birth			
	1964	1969	1974	1979
7-9 years of school attendance	60.6	46.9	29.7	29.2
10 years of school attendance	60.7	38.1	23.7	32.2
11-12 years of school attendance	59.6	41.1	24.7	34.9
13-14 years of school attendance	58.9	44.6	30.9	54.4

[1]) Not calculated for 15 or more years school attendance, which is a very small group

Table 4.11 Probability of having a third birth within 5 years after the second for women who were 30-34 years at second birth, by educational level. Per cent

Educational level	Second birth		
	1969	1974	1979
7-9 years of school attendance	25.5	17.4	17.3
10 years of school attendance	24.1	16.2	15.5
11-12 years of school attendance	32.9	22.4	20.4
13-14 years of school attendance	31.6	21.9	23.8
15 or more years of school attendance	34.4	24.5	24.7

Figure 4.4 Probability of having a third birth within 5 years after the second for women who were 25-29 years at second birth, by educational level. Per cent



attendance) the level 6 years after second birth is identical to the level 5 years earlier. The correlation is particularly large for women older than 25 at second birth, as few take a secondary education in their late 20s. Nevertheless, we cannot be sure that the data for the lowest educational groups are

acceptable. Certainly, an overwhelming majority of those who are registered with primary or secondary education 6 years after second birth have the same level 5 years earlier. However, some of those who are registered with a higher education may also have had a primary or secondary education 5 years earlier.

The situation is perhaps even more complex for women with more than 12 years school attendance. Previous investigations have revealed that about 25 per cent of the women in the 1945 cohort who at age 35 had attained a level corresponding to 13-14 years of schooling (e.g., nurse, teacher in primary school), had attained that level after age 25 (Kravdal, 1989). Let us illustrate this problem with an example: Some of the women who had a second birth at age 25-29 in 1974 are registered as having 13-14 years of schooling. Their third birth probability is 29.8 per cent. Most of the women had reached that educational level 1 year after the birth (in 1975), but some had a lower level at that time. The contribution from the latter group tends to reduce the third birth probability estimated for the group with 13-14 years education for two reasons. Firstly, the general pattern is that a lower educational level is associated with a somewhat lower third birth fertility. Secondly, it is reasonable to assume that the educational activity (required to increase the level) in itself depresses fertility. This kind of data limitation may explain a part of, but probably not the entire, upturn registered between 1974 and 1979 for the women with a higher education.

5. MULTIVARIATE MODELS OF THIRD BIRTH PROBABILITIES FOR MARRIED WOMEN

The relations between third birth probabilities and age at second birth, educational level, marital status and place of residence were discussed in chapter 4 on the basis of simple cross-tabulations of probabilities. The objective of chapter 5 is to assess the importance of other sociodemographic factors by using multivariate logistic models. In principle, this methodological framework would also serve to throw some more light on or modify the relations established in chapter 4, but it appears that the conclusions drawn in that chapter hold even when several additional variables are introduced as controls.

The focus is on women living in a never broken first marriage both at the time of second birth and 5 or 10 years later. Our most essential model estimates, which are referred to repeatedly throughout chapter 5, are presented in table 5.1. Estimates from a similar model are presented in table 5.2, except that the interval under study is 10 instead of 5 years.

Already at this stage we reveal that the parameters estimated in the models for 5- and 10-year probabilities are almost equal. The most pronounced difference is with respect to age, which will be discussed in section 5.1. For all other variables our focus is on the 5-year probabilities.

We do not display the gross effects of all variables, as they are generally very similar to the net effects. We merely point out that the estimated age effect is changed when the spacing is introduced, and vice versa. Besides, as explained in section 4.4.1, the estimated education effects are sensitive to the age control and the inclusion of a few other variables. Gross effects of education are exhibited in table 5.8.

Table 5.1 and 5.2 are based on husband's relative income, which we believe to be the most interesting income variable among those available to us. However, we also need to inspect models where the actual income is included. Parameters from such a model are presented in table 5.3 for a 5-year observation interval. We do not consider it necessary to repeat the calculations for a 10-year interval.

We have estimated all possible first order interaction effects involving what we consider the most interesting demographic and socioeconomic variables (age at first birth, second birth interval, education of both spouses, labour force participation, husband's relative income) and place of residence. This restriction of the set of variables is made because a very long computing-time (CPU-time) on a large mainframe computer is required (about 15 minutes for a model with main effects of the variables mentioned above). We also add that we have economized slightly with the number of categories. Only three levels were used for husband's education and relative income when we experimented with the interactions.

It turns out that the interactions contribute very little new insight beyond that obtained in a main effects model. Table 5.4 indicates the improvement of the model fit obtained when one interaction is added to the main effects model (in terms of decrease in the -2 log L, i.e. the likelihood, relative to the change in degrees of freedom) . Only the interaction between age and interbirth interval gives a significantly better model fit both for women having a second birth in 1969 and for those with a birth in 1979. This interaction as well as some of the other significant interactions are dicussed in sections 5.1-5.14, while others are totally ignored, as no meaningful pattern is detected.

Table 5.1 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 5 years after the second. Married women[1])

			Second birth 1969		Second birth 1979	
WOMAN'S AGE		20-22	0.06	(0.05)	0.25	(0.07)
	*	23-25	0		0	
		26-28	-0.08	(0.05)	-0.12	(0.06)
		29-31	-0.26	(0.07)	-0.39	(0.07)
		32-34	-0.65	(0.10)	-0.69	(0.09)
AGE DIFFERENCE BETWEEN SPOUSES		Husband more than 6 ys. older	0.02	(0.05)	0.04	(0.07)
	*	Husband 3-5 ys. older	0		0	
		Husband 0-2 ys. older	0.05	(0.04)	0.01	(0.05)
		Woman older	0.25	(0.07)	0.25	(0.08)
INTERVAL BETWEEN 1. AND 2. BIRTH		0-23 months	0.48	(0.04)	0.68	(0.06)
	*	24-47 months	0		0	
		48+ months	-0.49	(0.06)	-0.57	(0.05)
WOMAN'S EDUCATION	*	7- 9 ys. school attendance	0		0	
		10 ys. school attendance	-0.17	(0.05)	0.09	(0.05)
		11-12 ys. school attendance	0.14	(0.07)	0.15	(0.07)
		13-14 ys. school attendance	0.25	(0.09)	0.44	(0.08)
		15+ ys. school attendance	0.35	(0.16)	0.40	(0.11)
HUSBAND'S EDUCATION	*	7- 9 ys. school attendance	0		0	
		10 ys. school attendance	-0.15	(0.05)	0.10	(0.06)
		11-12 ys. school attendance	-0.12	(0.06)	0.12	(0.06)
		13-14 ys. school attendance	-0.15	(0.09)	0.18	(0.09)
		15-16 ys. school attendance	-0.04	(0.13)	0.45	(0.12)
		17+ ys. school attendance	0.18	(0.11)	0.56	(0.10)
WOMAN'S LAB. FORCE PARTICIP.	*	Not employed (less than 100h)	0		0	
		100-999 hours	-0.03	(0.06)	0.01	(0.05)
		1000+ hours	-0.14	(0.07)	-0.04	(0.07)
HUSBAND'S OCCUPATION		Technical, scientific work	-0.01	(0.09)	0.02	(0.08)
		Medical work	-0.05	(0.16)	0.26	(0.14)
		Pedagogical work	0.03	(0.11)	0.07	(0.11)
		Administration	0.06	(0.10)	-0.06	(0.10)
		Clerical work	-0.14	(0.08)	0.09	(0.11)
		Sales work, commerce	-0.21	(0.07)	-0.11	(0.09)
		Agriculture	0.40	(0.08)	0.43	(0.09)
		Transport, communications	-0.07	(0.06)	0.09	(0.08)
	*	Industry, craft	0		0	
		Other occupations	0.00	(0.08)	0.00	(0.08)
HUSBAND'S RELATIVE INCOME		-0.75	0.16	(0.07)	0.22	(0.08)
		0.76-0.90	0.11	(0.06)	0.14	(0.07)
	*	0.91-1.00	0		0	
		1.01-1.10	-0.02	(0.06)	0.04	(0.07)
		1.11-1.25	-0.02	(0.06)	0.06	(0.07)
		1.25+	0.00	(0.06)	0.03	(0.07)

cont.

Table 5.1 cont.

		Second birth 1969		Second birth 1979	
PLACE OF RESIDENCE	East, non-rural	-0.25	(0.06)	-0.20	(0.08)
	* East, rural	0		0	
	South and West, non-rural	0.26	(0.06)	0.42	(0.08)
	South and West, rural	0.72	(0.07)	0.82	(0.08)
	Middle and North, non-rural	0.04	(0.07)	0.12	(0.09)
	Middle and North, rural	0.40	(0.08)	0.40	(0.10)
PARENTS' EDUCATION	Not living with parents, or education unknown	-0.05	(0.07)	1.05	(0.54)
	* 7- 9 years school attendance	0		0	
	10-12 years school attendance	-0.06	(0.08)	0.24	(0.07)
	13+ years school attendance	0.23	(0.12)	0.03	(0.12)
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0		0	
	Both spouses members of another religious society	0.52	(0.14)	0.91	(0.13)
	None of the spouses members of a religious society	-0.27	(0.27)	-0.26	(0.15)
	All other combinations	0.11	(0.08)	0.10	(0.07)
CONSTANT TERM		-0.73	(0.08)	-1.59	(0.10)

* Baseline group
[1]) Living in a first never broken marriage at second birth and 5 years afterwards

As explained in section 3.3 it was not feasible to accomodate the timing of first birth in the models. The effect of this variable is measured in separate models where we have excluded the women for whom we only know the year of marriage.

To obtain a certain impression of the relative importance of the variables, we have performed significance tests based on a comparison between a full main effects model and models where a single factor is excluded (table 5.5). Due to the long CPU-time, we have confined ourselves to women with a second birth in 1979. A quick glance at the table reveals that the demographic variables and place of residence account for a substantial proportion of the total variation, while the economic factors play a minor role. A warning is appropriate, however. Including several categories with almost the same fertility level, as we have done for husband's income for purely illustrative purposes, distorts the picture slightly. With fewer categories a somewhat stronger explanatory power would have been obtained, though this would by no means alter the main impression of relative importance.

In order to study the relationship between third birth probabilities and the woman's occupation and income the year after second birth we have estimated models for the women in gainful employment exclusively (tables 5.6 - 5.7). The

Table 5.2 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 10 years after the second. Married women[1])

		Second birth 1969	
WOMAN'S AGE	20-22	0.18	(0.05)
	* 23-25	0	
	26-28	-0.20	(0.05)
	29-31	-0.51	(0.06)
	32-34	-1.00	(0.10)
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	0.01	(0.05)
	* Husband 3-5 ys. older	0	
	Husband 0-2 ys. older	0.09	(0.04)
	Woman older	0.29	(0.07)
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	0.49	(0.04)
	* 24-47 months	0	
	48+ months	-0.57	(0.05)
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0	
	10 ys. school attendance	-0.17	(0.05)
	11-12 ys. school attendance	0.16	(0.07)
	13-14 ys. school attendance	0.32	(0.09)
	15+ ys. school attendance	0.42	(0.17)
HUSBAND'S EDUCATION	* 7- 9 ys. school attendance	0	
	10 ys. school attendance	-0.16	(0.05)
	11-12 ys. school attendance	-0.07	(0.06)
	13-14 ys. school attendance	-0.01	(0.09)
	15-16 ys. school attendance	0.02	(0.14)
	17+ ys. school attendance	0.25	(0.11)
WOMAN'S LAB. FORCE PARTICIP.	* Not employed (less than 100h)	0	
	100-999 hours	-0.03	(0.06)
	1000+ hours	-0.16	(0.07)
HUSBAND'S OCCUPATION	Technical, scientific work	0.04	(0.09)
	Medical work	0.09	(0.18)
	Pedagogical work	-0.02	(0.11)
	Administration	0.04	(0.10)
	Clerical work	-0.08	(0.08)
	Sales work, commerce	-0.17	(0.07)
	Agriculture	0.59	(0.08)
	Transport, communications	-0.02	(0.06)
	* Industry, craft	0	
	Other occupations	-0.04	(0.08)
HUSBAND'S RELATIVE INCOME	-0.75	0.23	(0.07)
	0.76-0.90	0.18	(0.06)
	* 0.91-1.00	0	
	1.01-1.10	0.07	(0.06)
	1.11-1.25	0.03	(0.06)
	1.25+	0.03	(0.06)

cont.

Table 5.2 cont.

		Second birth 1969	
PLACE OF RESIDENCE	East, non-rural	-0.20	(0.06)
	* East, rural	0	
	South and West, non-rural	0.41	(0.07)
	South and West, rural	0.86	(0.08)
	Middle and North, non-rural	0.12	(0.07)
	Middle and North, rural	0.60	(0.08)
PARENTS' EDUCATION	Not living with parents, or education unknown	-0.10	(0.07)
	* 7- 9 years school attendance	0	
	10-12 years school attendance	0.01	(0.08)
	13+ years school attendance	0.18	(0.12)
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0	
	Both spouses members of another religious society	0.81	(0.15)
	None of the spouses members of a religious society	-0.30	(0.27)
	All other combinations	0.18	(0.08)
CONSTANT TERM		-0.38	(0.08)

* Baseline group
[1]) Living in a first never broken marriage at second birth and 10 years afterwards

effects of all other variables are largely the same in these models as in the models comprising all married women, so they are not commented on except in the sections on the husband's occupation and income.

The effects of "sex of previous children" and "change of partner" were considered in a previous study of parity three transitions by Brunborg and Kravdal (1986), but these two variables are now left out. It was found that couples having one boy and one girl had 18 per cent lower third birth intensities than those having either two girls or two boys, but this is a small effect compared to that of other sociodemographic factors. The impact on the third birth probabilities of a change of partner between first and second birth (first and second child having different fathers) is considerably larger, but in this chapter the focus is on stable marriages. The effect of a marital break-up prior to second birth was discussed briefly in section 4.2.

We now discuss each variable separately in sections 5.1-5.14 (in a sequence not depending on their relative importance), while the last section of the chapter (5.15) is devoted to a brief discussion of whether the variables included in this study are able to explain the downward trend in the third birth progressions.

Table 5.3 Parameter estimates in logistic regression models for the probability of having a third birth within 5 years after the second. Married women[1])

		Second birth 1969		Second birth 1979	
		Model 1	Model 2	Model 1	Model 2
WOMAN'S AGE	20-22	0.05	0.06	0.25	0.26
	* 23-25	0		0	
	26-28	-0.08	-0.09	-0.11	-0.12
	29-31	-0.26	-0.27	-0.38	-0.39
	32-34	-0.64	-0.65	-0.66	-0.68
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	0.03	0.03	0.05	0.05
	* Husband 3-5 ys. older	0	0	0	0
	Husband 0-2 ys. older	0.04	0.05	0.01	0.01
	Woman older	0.23	0.25	0.24	0.25
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	0.48	0.49	0.68	0.69
	* 24-47 months	0	0	0	0
	48+ months	-0.49	-0.49	-0.57	-0.56
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0	0	0	0
	10 ys. school attendance	-0.17	-0.17	0.09	0.09
	11-12 ys. school attendance	0.14	0.14	0.15	0.15
	13-14 ys. school attendance	0.25	0.24	0.44	0.44
	15+ ys. school attendance	0.35	0.33	0.40	0.40
HUSBAND'S EDUCATION	* 7- 9 ys. school attendance	0	0	0	0
	10 ys. school attendance	-0.14	-0.15	0.10	0.10
	11-12 ys. school attendance	-0.11	-0.13	0.13	0.12
	13-14 ys. school attendance	-0.14	-0.16	0.20	0.18
	15-16 ys. school attendance	-0.03	-0.04	0.46	0.45
	17+ ys. school attendance	0.19	0.18	0.58	0.56
WOMAN'S LAB. FORCE PARTICIP.	* Not employed (less than 100h)	0	0	0	0
	100-999 hours	-0.03	-0.01	0.01	0.02
	1000+ hours	-0.14	-0.12	-0.04	-0.02
HUSBAND'S OCCUPATION	Technical, scientific work	-0.01	-0.01	0.03	0.01
	Medical work	-0.04	-0.03	0.29	0.29
	Pedagogical work	0.04	0.02	0.07	0.05
	Administration	0.08	0.07	-0.04	-0.05
	Clerical work	-0.13	-0.14	0.09	0.09
	Sales work, commerce	-0.21	-0.19	-0.10	-0.09
	Agriculture	0.37	0.41	0.42	0.46
	Transport, communications	-0.06	-0.06	0.11	0.11
	* Industry, craft	0	0	0	0
	Other occupations	0.00	0.01	0.01	0.01
HUSBAND'S ACTUAL INCOME[2])	Very low	0.20		0.18	
	Low	0.14		0.18	
	* Slightly lower than average	0		0	
	Slightly higher than average	0.01		-0.06	
	High	0.02		-0.01	
	Very high	0.05		0.06	

cont.

Table 5.3 cont.

		Second birth 1969		Second birth 1979	
		Model 1	Model 2	Model 1	Model 2
PLACE OF RESIDENCE	East, non-rural	-0.26	-0.27	-0.20	-0.22
	* East, rural	0	0	0	0
	South and West, non-rural	0.26	0.25	0.43	0.40
	South and West, rural	0.71	0.72	0.82	0.81
	Middle and North, non-rural	0.04	0.04	0.13	0.11
	Middle and North, rural	0.40	0.42	0.40	0.42
PARENTS' EDUCATION	Not living with parents, or education unknown	-0.05	-0.05	1.02	1.05
	* 7- 9 years school attendance	0	0	0	0
	10-12 years school attendance	-0.06	-0.06	0.24	0.24
	13+ years school attendance	0.22	0.23	0.03	0.03
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0	0	0	0
	Both spouses members of another religious society	0.52	0.53	0.92	0.92
	None of the spouses members of a religious society	-0.26	-0.25	-0.25	-0.23
	All other combinations	0.11	0.11	0.10	0.10
CONSTANT TERM		-0.77	-0.69	-1.61	-1.52

* Baseline group
1) See note table 2.2
2) See chapter 2 for detailed description of categories

5.1 The woman's age

We found in section 4.1, where no controls were included, that the third birth probabilities are lower, the higher the age at second birth. The differences between the three 5-year age groups were about the same in 1979 as in 1969. There was, however, a slight increase in the probabilities of the youngest women relative to the other age groups. This trend also appears in table 5.2, which is based on 3-year age groups and multivariate models for married women.

Inclusion of controls affects the estimates of the age effect. Part of the gross age effect referred to in section 4.1 is explained by the spacing variable. For instance, for women having a second birth in 1979 the difference in third birth probabilities between age 29-31 and 23-25 is reduced from 0.58 to 0.39 when the spacing variable is included (not shown). The reason is, of course, that women who have a second birth at a fairly high age, tend to have a longer interval between first and second birth than the younger women. A longer interval is associated with lower subsequent fertility (see section 5.3).

Table 5.4 Significance of interactions

Interaction[1]		Difference in log-likelihood[2]		Degrees of freedom[3]	Significance level[4]	
		1969	1979		1969	1979
Age	* Woman's education	25.9	17.5	16		
	* Husband's education	17.3	8.4	8	<0.05	
	* Labour force participation	10.7	10.2	8		
	* Interbirth interval	40.9	21.9	8	<0.01	<0.01
	* Place of residence	22.8	23.3	20		
	* Husband's relative income	6.3	15.5	8		
Woman's education	* Husband's education	19.6	6.9	8	<0.05	
	* Labour force participation	2.5	20.6	8		<0.01
	* Interbirth interval	4.4	12.8	8		
	* Place of residence	29.6	33.8	20		<0.05
	* Husband's relative income	8.1	17.8	8		<0.05
Husband's education	* Labour force participation	5.2	4.3	4		
	* Interbirth interval	7.9	7.3	4		
	* Place of residence	37.2	17.7	10	<0.01	
	* Husband's relative income	3.6	2.1	4		
Labour force paticipation	* Interbirth interval	4.0	5.9	4		
	* Place of residence	14.2	7.9	10		
	* Husband's relative income	1.6	6.9	4		

cont.

Table 5.4 cont.

Interaction[1])	Difference in log-likelihood[2])		Degrees of freedom[3])	Significance level[4])	
	1969	1979		1969	1979
Interbirth interval * Place of residence	11.7	13.7	10		
Interbirth interval * Husband's relative income	2.8	3.8	4		
Place of residence * Husband's relative income	13.8	10.4	10		

[1]) The model includes the main effects of woman's age and interval between previous births, her labour force participation, husband's relative income, both spouses' education and their place of residence, as well as the indicated interaction
[2]) Log-likelihood (minus two times the logarithm of the likelihood, to be exact) of the interaction model being tested minus the log-likelihood of the main effects model
[3]) Number of parameters to be estimated in the interaction model minus the number of parameters to be estimated in the main effects model
[4]) Level >0.05 if not indicated

Table 5.5 Significance of variables[1]). Second birth 1979

Excluded variable	Difference in log-likelihood[2])	Degrees of freedom[3])
Interbirth interval	345.2	2
Place of residence	270.5	5
Age at second birth	102.5	4
Religious denomination	55.5	3
Woman's education	33.5	4
Husband's education	31.7	5
Husband's occupation	30.5	9
Parents' education	14.6	3
Age difference	12.2	3
Husband's relative income	15.4	5
Labour force participation	0.4	2

[1]) Testing a full main effect model (including woman's age and interval between previous births, age difference between the spouses, education and religion of both spouses, the woman's labour force participation, husband's occupation and relative income, the parents' education, place of residence) versus a main effect model where one variable is excluded
[2]) Difference in -2 log L between the two models
[3]) Difference in the number of parameters in the two models

Table 5.6 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 5 years after the second. Employed married women[1])

		Second birth 1969		Second birth 1979	
WOMAN'S AGE	20-22	0.03	(0.15)	0.16	(0.14)
	* 23-25	0		0	
	26-28	-0.18	(0.11)	-0.13	(0.10)
	29-31	-0.07	(0.13)	-0.40	(0.11)
	32-34	-0.50	(0.19)	-0.77	(0.14)
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	-0.02	(0.13)	0.10	(0.12)
	* Husband 3-5 ys. older	0		0	
	Husband 0-2 ys. older	0.07	(0.10)	0.09	(0.08)
	Woman older	0.32	(0.15)	0.28	(0.12)
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	0.46	(0.10)	0.78	(0.10)
	* 24-47 months	0		0	
	48+ months	-0.39	(0.12)	-0.60	(0.08)
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	-0.12	(0.12)	0.14	(0.10)
	11-12 ys. school attendance	0.12	(0.16)	0.16	(0.13)
	13-14 ys. school attendance	0.38	(0.20)	0.48	(0.13)
	15+ ys. school attendance	0.53	(0.25)	0.59	(0.18)
HUSBAND'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	-0.03	(0.12)	0.21	(0.11)
	11-12 ys. school attendance	0.14	(0.14)	0.25	(0.11)
	13-14 ys. school attendance	0.22	(0.20)	0.21	(0.14)
	15-16 ys. school attendance	0.33	(0.25)	0.48	(0.18)
	17+ ys. school attendance	0.32	(0.23)	0.69	(0.16)
WOMAN'S LAB. FORCE PARTICIP.	* 100-999 hours	0		0	
	1000+ hours	-0.08	(0.12)	-0.03	(0.09)
WOMAN'S OCCUPATION	Technical, scientific work	0.13	(0.33)	-0.44	(0.25)
	Medical work	0.32	(0.24)	0.05	(0.20)
	Pedagogical work	-0.09	(0.27)	-0.27	(0.23)
	Clerical work	0.05	(0.22)	-0.29	(0.20)
	Sales work, commerce	-0.18	(0.21)	-0.21	(0.24)
	Agriculture	0.35	(0.28)	0.36	(0.24)
	* Industry, craft	0		0	
	Hotel, restaurant, charwork	0.04	(0.24)	-0.02	(0.20)
	Other occupations	0.33	(0.24)	-0.17	(0.21)
HUSBAND'S OCCUPATION	Technical, scientific work	-0.33	(0.22)	0.09	(0.14)
	Medical work	-0.16	(0.31)	0.15	(0.20)
	Pedagogical work	-0.29	(0.21)	0.06	(0.15)
	Administration	0.08	(0.23)	-0.14	(0.16)
	Clerical work	-0.15	(0.20)	0.08	(0.17)
	Sales work, commerce	-0.15	(0.18)	-0.09	(0.15)
	Agriculture	0.24	(0.20)	0.27	(0.16)
	Transport, communications	-0.19	(0.18)	-0.03	(0.15)
	* Industry, craft	0		0	
	Other occupations	-0.11	(0.18)	-0.09	(0.14)

cont.

Table 5.6 cont.

		Second birth 1969		Second birth 1979	
WOMAN'S INCOME[2])	0	0.12	(0.16)	0.16	(0.18)
	Low	0.09	(0.14)	0.08	(0.09)
	* Medium	0		0	
	High	0.06	(0.14)	0.02	(0.11)
HUSBAND'S RELATIVE INCOME	-0.75	-0.13	(0.14)	0.12	(0.12)
	0.76-0.90	-0.22	(0.15)	0.12	(0.11)
	* 0.91-1.00	0		0	
	1.01-1.10	-0.15	(0.15)	-0.06	(0.12)
	1.11-1.25	-0.19	(0.15)	-0.01	(0.13)
	1.25+	-0.24	(0.15)	-0.11	(0.12)
PLACE OF RESIDENCE	East, non-rural	-0.39	(0.16)	-0.19	(0.13)
	* East, rural	0		0	
	South and West, non-rural	-0.05	(0.17)	0.47	(0.14)
	South and West, rural	0.57	(0.17)	0.62	(0.15)
	Middle and North, non-rural	-0.14	(0.18)	0.14	(0.15)
	Middle and North, rural	0.31	(0.18)	0.29	(0.17)
PARENTS' EDUCATION	Not living with parents, or education unknown	-0.30	(0.16)	2.05	(0.88)
	* 7- 9 years school attendance	0		0	
	10-12 years school attendance	0.08	(0.15)	0.12	(0.11)
	13+ years school attendance	0.05	(0.22)	0.01	(0.16)
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0		0	
	Both spouses members of another religious society	0.04	(0.33)	0.68	(0.22)
	None of the spouses members of a religious society	-1.03	(0.57)	-0.47	(0.20)
	All other combinations	-0.06	(0.17)	0.06	(0.11)
CONSTANT TERM		-0.66	(0.28)	-1.53	(0.23)

* Baseline group
[1]) See note table 5.1
[2]) See chapter 2 for detailed description of categories

The age effect is much larger when we model 10-year probabilities than when we model 5-year probabilities (compare tables 5.1 and 5.2). This may be illustrated by comparing women who are 29-31 years at second birth with those who are 23-25 years. A 10-year observation period implies that the two groups can be studied from age 29 to 41 and from age 23 to 35, respectively, while a 5-year period gives 29-36 and 23-30 as the corresponding age spans. The fact that the third birth probabilities differ more between ages 29-41 and 23-35 than between 29-36 and 23-30, simply reflects that third birth fertility is more sensitive to age at higher ages. In particular, the women who are 32-34 years old at the time of second birth have very low 10-year probabilities, as fertility for different reasons tend to be very low when the women enter their 40s.

Table 5.7 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 10 years after the second. Employed married women[1])

		Second birth 1969	
WOMAN'S AGE	20-22	0.14	(0.15)
	* 23-25	0	
	26-28	-0.30	(0.11)
	29-31	-0.25	(0.14)
	32-34	-0.90	(0.20)
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	0.03	(0.13)
	* Husband 3-5 ys. older	0	
	Husband 0-2 ys. older	0.22	(0.11)
	Woman older	0.36	(0.15)
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	0.55	(0.10)
	* 24-47 months	0	
	48+ months	-0.39	(0.12)
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0	
	10 ys. school attendance	-0.05	(0.13)
	11-12 ys. school attendance	0.25	(0.16)
	13-14 ys. school attendance	0.47	(0.20)
	15+ ys. school attendance	0.62	(0.26)
HUSBAND'S EDUCATION	* 7- 9 ys. school attendance	0	
	10 ys. school attendance	-0.14	(0.12)
	11-12 ys. school attendance	0.02	(0.14)
	13-14 ys. school attendance	0.37	(0.20)
	15-16 ys. school attendance	0.43	(0.26)
	17+ ys. school attendance	0.30	(0.23)
WOMAN'S LAB. FORCE PARTICIP.	* 100-999 hours	0	
	1000+ hours	-0.12	(0.12)
WOMAN'S OCCUPATION	Technical, scientific work	0.14	(0.34)
	Medical work	0.34	(0.24)
	Pedagogical work	-0.02	(0.27)
	Clerical work	0.07	(0.22)
	Sales work, commerce	-0.23	(0.25)
	Agriculture	0.55	(0.29)
	* Industry, craft	0	
	Hotel, restaurant, charwork	-0.03	(0.24)
	Other occupations	0.15	(0.24)
HUSBAND'S OCCUPATION	Technical, scientific work	-0.18	(0.21)
	Medical work	-0.06	(0.32)
	Pedagogical work	-0.23	(0.21)
	Administration	0.14	(0.23)
	Clerical work	0.06	(0.20)
	Sales work, commerce	-0.06	(0.17)
	Agriculture	0.53	(0.20)
	Transport, communications	0.01	(0.18)
	* Industry, craft	0	
	Other occupations	-0.04	(0.18)

cont.

Table 5.7 cont.

		Second birth 1969	
WOMAN'S INCOME[2])	0	0.11	(0.16)
	Low	0.01	(0.14)
	* Medium	0	
	High	0.07	(0.14)
HUSBAND'S RELATIVE INCOME	-0.75	0.00	(0.15)
	0.76-0.90	-0.07	(0.15)
	* 0.91-1.00	0	
	1.01-1.10	-0.02	(0.16)
	1.11-1.25	-0.05	(0.15)
	1.25+	-0.08	(0.15)
PLACE OF RESIDENCE	East, non-rural	-0.33	(0.16)
	* East, rural	0	
	South and West, non-rural	0.18	(0.17)
	South and West, rural	0.65	(0.18)
	Middle and North, non-rural	-0.02	(0.18)
	Middle and North, rural	0.44	(0.19)
PARENTS' EDUCATION	Not living with parents, or education unknown	-0.31	(0.16)
	* 7- 9 years school attendance	0	
	10-12 years school attendance	0.08	(0.16)
	13+ years school attendance	-0.09	(0.22)
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0	
	Both spouses members of another religious society	0.67	(0.33)
	None of the spouses members of a religious society	-0.85	(0.55)
	All other combinations	-0.01	(0.18)
CONSTANT TERM		-0.55	(0.28)

* Baseline group
[1]) See note table 5.3
[2]) See chapter 2 for detailed description of categories

The effect of age is addressed in several other investigations. For instance, Finnäs and Hoem (1980) have found a negative effect of age at second birth on the third birth probabilities. Moreover, Bumpass et al. (1978) have found a negative effect of age at first birth on the pace of subsequent fertility - also for transitions to parity three. Hoem and Hoem (1989) have also observed a very clear age effect in the same direction. This effect of age at first birth is consistent with our own results, as a low age at first birth goes along with a low age at second birth. (However, we have not found a positive effect of age at first birth when the age at second birth is kept constant. On the contrary, when the age at second birth is fixed, the third birth probabilities are reduced with increasing interval between first and second birth, i.e. with lower age at first birth.)

Apparently, the age in itself is considered an obstacle to further childbearing - other characteristics kept fixed. It seems unlikely that this is mainly a result of reduced fecundity (for a discussion of fecundity see Menken, 1985). A 28 year old women should have almost as good chances of having a third child within 5 years as a 23 year old woman if she wants to.

In our view the results may partly reflect that the opportunity costs of childbearing are perceived to be higher by older women, who perhaps are more strongly established in the labour market. When other variables are controlled, a higher age at second birth implies that the woman is older at first birth and may have established a strong work commitment during her years as a childless adult. Certainly, we have a control for gainful employment, but as explained in section 5.6 we do not altogether rely on its ability to capture the effect of labour force attachment.

We also believe that the negative age effect is a manifestation of a selection mechanism. Women who have had an early second birth, and thus also an early first birth, may be strongly oriented towards familial activities, may even have planned a large family, or may be "reproduction-prone" for other reasons, for instance because of inefficient contraceptive use. Similar factors are likely to account for the relatively low third birth probabilities associated with a late entry into parenthood, and, in addition, subfecundity may play an important role.

5.2 The age difference between spouses

As childbearing within marriage is the outcome of a decision normally taken by a couple, and not only by a woman, the husband's characteristics probably also have some importance as determinants.

It appears in table 5.1 that there is a significant positive effect of having a younger husband, while there is no effect of having a husband who is more than 6 years older, compared to having a husband who is 0-2 years older. Evidently, the importance of the husband's age is much smaller than that of the woman's age. An alternative and simple way of illustrating this would be to include both ages as continuous covariates (first degree polynomial) along with some other important factors. Among couples having their second child in 1969 we found that the effect of woman's age was -0.032 per year, while it was only -0.003 for husband's age.

The results may suggest that an additional child generally affects the woman's life more than that of the husband, and consequently is more dependent on her characteristics. We also point out that the biological barriers to childbearing, which we considered to be of a fairly moderate importance in section 5.2, are much more dependent on the woman's than on the husband's age.

5.3 The interval between first and second birth

There is a large amount of evidence from industrialized societies (see e.g. Hoem and Hoem, 1989) as well as from the developing countries (see e.g. Rodriguez et al., 1984) that the length of the interbirth interval is a strong determinant of subsequent fertility. This is usually taken to reflect differences in contraceptive use, lactation practice (in particular in developing countries), childbearing intentions etc. Also fecundity is considered

to be an important factor, but there is some evidence which casts doubt on this (Hoem, 1988).

Stated differently, women who are prone to have many children, also tend to have short intervals between first and second birth. The differences in "fertility proneness" are not entirely picked up by other variables included in the models. Thus, from an analytic point of view it is a disappointment that the interval variable has such a large effect. It leaves us with very little information about the mechanisms underlying the differences in reproductive behaviour.

We would like to add that Heckman et al. (1985) have approached the issue of timing and spacing of births with models including controls for unobserved heterogeneity. They have found that a very long first birth interval leads to a short second birth interval and vice versa, and contend that this is consistent with a "fixed target model of fertility, in which a delay in the arrival of one child is compensated for by an acceleration of the rate of arrival of the next child".

Tables 5.1 and 5.2 reveal that there is a large effect of the interbirth interval in our data. Moreover, the interaction between age at second birth and interbirth interval appears to be significant (see table 5.4) and has a clear pattern. As age increases, the effect of interval also increases. This may be partly explained by our categorization. In fact, when we include the interval as a continuous variable (of first degree) there is no clear change in the parameter estimates across age groups. The range of possible interbirth intervals is longer, the higher the age at second birth. For the oldest women in our sample a smaller proportion have an interval shorter than 2 years (13 per cent at age 32-34, as opposed to 36 per cent at age 23-25), and an interval longer than 4 years can in principle be as long as 10 years or more for women who have entered their 30s at second birth, but seldom more than 6 years for women at age 25. A more demographically interesting interpretation might be that the interaction reflects the relatively high fertility of women who have planned a family with three or more children, but have deliberately postponed the first birth, after which they have their children in rapid succession.

Our results confirm previous findings from Norway that intervals shorter than 2 years are connected with a third birth intensity about 50 per cent higher than when the interval is 2-4 years, while there is a reduction of the intensities of about 50 per cent if the interval is longer than 4 years (Brunborg and Kravdal, 1986).

5.4 The woman's education

5.4.1 Main empirical results

In section 4.4 we found a positive gross effect of education among women delivering their second child in the late 1970s. Prior to 1975 the gross effect was U-shaped, with a particularly low fertility among those with 10 years school attendance. Within each 5-year age group there is generally a clear positive effect regardless of the year at second birth (except for the youngest women with a birth before 1975).

We have experimented with different multivariate models, and have found that the effect of the woman's education increases when the age is controlled, and

when the place of residence is controlled (only among those with a second birth in 1969), but is attenuated when the husband's education is included (only among those with a second birth in 1979).

Table 5.8 shows the gross and net effects of the woman's education. We note that both among those with a second birth in 1969 and those with a second birth in 1979 there is a significant positive net effect of education.

Table 5.8 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 5 years after the second. Married women. Gross and net effects

a) Women with a second birth in 1969

		Net effects [1]		Gross effects	
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	-0.17	(0.05)	-0.27	(0.04)
	11-12 ys. school attendance	0.14	(0.07)	-0.03	(0.06)
	13-14 ys. school attendance	0.25	(0.09)	0.03	(0.07)
	15+ ys. school attendance	0.35	(0.16)	0.08	(0.13)

b) Women with a second birth in 1979

		Net effects [1]		Gross effects	
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	0.09	(0.05)	0.28	(0.05)
	11-12 ys. school attendance	0.15	(0.07)	0.32	(0.06)
	13-14 ys. school attendance	0.44	(0.08)	0.55	(0.06)
	15+ ys. school attendance	0.40	(0.11)	0.56	(0.08)

[1] Controlled for woman's age and labour force participation, age difference between the spouses, husband's education, relative income and occupation, place of residence, interval between first and second birth, and the education of the woman's parents.

These results are for a 5-year observation interval, and we repeat that a positive gross effect not is found within the 1945 birth cohort, but, of course, may show up in other, not least the younger, cohorts. No positive gross effect of education is found with a 10-year interval, as only those with a second birth prior to 1975 could be observed for such a long period of time. Consequently, we cannot rule out the possibility that there is only a quicker transition among the highly educated, and not a larger proportion eventually reaching parity three. The net effect, however, is positive also with a 10-year interval (table 5.2).

5.4.2 Explaining the positive effect of educational attainment

In our view, the result deserving most attention is the fact that the direct effect of high education generally is strongly positive, and that it, for the women with a second birth in the late 1970s, even overrides the subduing effect of a higher age, and produces a positive gross effect. Such a positive direct effect has taken us with some surprise, as the women with a secondary education, and in particular those with a university degree, are usually supposed to have higher opportunity costs of childbearing, and also may be more able to control their fertility (see e.g., Westoff, 1981).

As a first stage of the discussion of the education effect, we point out once again that our probabilities are conditioned on having had a second child, and that there is a smaller group who reach parity two among the women with high education (see section 4.4.3). Due to this selectivity it would not be unlikely that the attitudes towards further childbearing and childrearing are more positive among the highly educated two-child mothers than among those with a lower education. This may account for part of the observed educational differences in third birth progressions.

The remaining part of the discussion is focused on economic factors as possible explanations. First, let us turn to the association between fertility and husband's education (see also section 5.5). One might assume that there is some effect through income, as income is often supposed to have a positive effect on fertility (see e.g. Becker, 1960), and as there is a strong relation between income and education. However, the empirical evidence reported in the literature is conflicting, and the Norwegian data give no support to a positive income effect (see section 5.10), so we feel convinced that other factors are mainly responsible for the positive effect of husband's education.

The woman's education is, of course, positively related to the husband's education, and, as alluded to above, the positive effect of her education is partly explained by his education, and in turn the factors that contribute to give women married to men with a high education a high propensity to have a third child.

Another factor which is reasonable to consider in order to explain the positive effect of the woman's education is her own potential income. Traditionally, it has been argued that a higher potential income goes along with a lower fertility, as the positive effect that her income may have through its contribution to the total economic well-being of the family (according to the "Becker school") is not sufficient to outweigh the negative effect of the opportunity costs (Mincer, 1963). (Note in this respect that even though several scholars have severe doubts whether there is a positive effect on fertility of the husband's income, there may still be a positive effect of the woman's contribution to the family income. Our idea, perhaps somewhat far-fetched, is that if the family income is not considered as a common pool of resources, some of the economic priorities may depend primarily on the woman's income, and others on the husband's income). If we assume that the woman's contribution to the family income has a positive effect on fertility, it is possible that the high proportion of third birth progressions among the highly educated women during the late 1970s and the 1980s has emerged because the so-called income effect actually outweighs the opportunity cost effect. We point out in particular that such an advantage of the higher social groups may reflect that

opportunity costs do not increase as much with income as usually taken for granted. This is because labour force participation is facilitated through paid child care, which costs more or less the same regardless of social class.

Attempts have been made to estimate the effect of the woman's own income on fertility (see section 5.9), but considering the data limitations, the results are almost inconclusive.

Another possible explanation of the positive education effect is that women with high education may have jobs with more flexible working-time, so that the occupational and maternal roles are somewhat less incompatible. For instance, the teachers constitute a major part of the high education group, and usually have a relatively high flexibility in working-hours. It turns out that a control for the woman's occupation does not explain the positive education effect, but, this, of course, does not invalidate our flexible-working-time argument.

5.4.3 Other empirical investigations

There has been some attention to the relation between education level and third birth fertility in the literature. Also Hoem and Hoem (1989) have found a positive net effect of education - though diminishing over time - and speculate whether this should be interpreted as an income effect that outweighs the opportunity cost effect. According to unpublished tables, they have also found a positive gross effect (B. Hoem, personal communications 1990). Their study is based on a cohort approach, which failed to give a positive education effect in our brief inspection of the Norwegian women born in 1945 (see section 4.4.3).

A similar investigation based on British data suggests that education is unrelated to subsequent fertility among two-child mothers (Wright et al., 1988), while Ware (1976) has found a very strong effect of education on the desire to have a third child in Australia. Less agreement with our own results is found in Jensen and Schweder's (1988) work. They conclude that there is a strong negative effect of education on third birth intensities among Norwegian women who have been in the labour force after second birth. Difficulties with the labour force variable may have biased their estimates, however.

5.4.4 Educational activity as a determinant of third births

The final issue that we want to address with respect to the woman's education is the relation between educational activity and third birth probabilities. Our previous study demonstrated that a change of educational level after the age of 25 is inversely related to total cohort fertility measured at age 39 (Kravdal, 1989). Among women with a certain educational level at age 35, those who have reached this level after age 25 have the lowest fertility.

In the entire population of married women only about 1 per cent are registered with educational activity the year after second birth. Among women with more than 13 years of school attendance the percentage is approximately 3. Due to the small group who are taking further education at this stage of life the educational activity is not included as a separate variable in our main tables. However, we have run some regression models exclusively for women with more than 13 years of school attendance, and have found a significant negative effect (-0.6 for women with a second birth in 1969 and -0.5 for women with a

second birth in 1979) on the third birth probabilities. The proportion of husbands with educational activity is somewhat higher, but their enrollment does not seem to affect subsequent fertility.

In principle we might also have examined the effect of educational activity prior to the second birth, measured by the difference in educational levels between two censuses, but we have not given this priority.

5.5 The husband's education

The net effect of the husband's education appears to be even larger than that of the woman's education among those giving birth to a second child in 1979. In the 1969 second parity cohort there is a significant negative net effect of medium education and no net effect of a higher education. However, the estimated parameters take a larger value the higher the education, once a level corresponding to 13 years school attendance has been reached.

The significant interaction (among women having a second birth in 1969) between husband's education and place of residence (see table 5.4) reveals that there is a positive effect of high education in the non-rural areas of Eastern Norway. It is negative in all other areas. The interaction between the husband's eduaction and that of the wife does not significantly improve the model fit, but the estimated interaction parameters exhibit an interpretable structure: There is a negative effect of husband's education when the woman has a low education , a small effect when the woman has medium education, and a positive effect when the women has a high education. In other words, educational heterogamy is associated with particularly low fertility. A similar result is found for total cohort and period fertility by Kiser et al. (1968), Cho et al. (1971), and Rindfuss and Sweet (1978).

In the models referred in table 5.1 the husband's relative income is included. As this income concept relates actual income to the income expected partly from his educational level, it does not vary much by educational level, and is in principle not well suited as a candidate to "explain" the education effect. Therefore, we have estimated a few models with actual income included as a regressor (see table 5.3). It turns out - not surprisingly - that actual income has a negative net effect on fertility, just as relative income (see section 5.10), and that the inclusion of this variable has virtually no effect on the parameter estimates for the education effect. Consequently, we are inclined to interpret the results primarily as caused by other factors than differences in the economic situation.

The explanation referring to the work-family incompatibility (see section 5.4.2) is attractive in the sense that it may explain the higher effect of the woman's education than that of the husband, which we found among women delivering their second child in 1969. Presumably, there is less interaction between the husband's different arenas of life. Though the fathers' participation in child care is an important contribution (Presser, 1989), they still have the role as secondary care-takers. Consequently, it is reasonable to believe that more flexible working-time for them does not have the same positive effect on fertility as more flexible working-time for the women.

5.6 The woman's labour force participation

5.6.1 Introductory remarks

From a demographic perspective a particularly interesting question is whether the substantial increase in female labour force participation has had an inhibiting effect on fertility, or whether the downward trend in reproduction should be explained primarily by other factors.

We know from other investigations that a combination between motherhood and labour force participation has become gradually more common in Norway as in most other industrialized countries. For instance, Ellingsæter and Iversen (1984) have found that in 1980, 70 per cent of the two-child mothers with a youngest child aged 3-6 had paid work. The corresponding proportion 10 years earlier was 35 per cent. If the youngest child was 0-2 years, the proportions were 56 and 31, respectively. Evidently, Norwegian women define paid work as more of a central life interest than they did a few decades ago, but we do not know to what extent pursuing a "career role" in the occupational world affects their total cohort fertility.

There is general consensus among demographers and economists that there is a strong negative relationship between paid work and fertility. The direction of causality is unclear, however (Cramer, 1980; Sweet, 1981). Several attempts are made to model both directions (Hout, 1978; Waite and Stolzenberg, 1976; Cramer, 1980; Klijzing et al., 1988), and there appears to be more support for a negative effect of (small) children on labour force participation than for a negative effect of labour force participation on fertility. A common view is that childbearing and labour force behaviour are outcomes of simultaneous decisions. It has also been argued that much of the negative relationship is spurious and due to the influence of factors like farm background and education (Terry, 1975).

5.6.2 Labour force participation one year after second birth

The available variables limit the analytical possibilities considerably. We have only access to "labour force participation one year after second birth". Probably, this serves partly as a signal of work intentions, as argued by Ni Bhrolchain (1986) and Mott and Shapiro (1983), or sex role orientation. Unfortunately, there are also good reasons to believe that the employment immediately after second birth may be very weakly related to the real work commitment. Most women eventually resume gainful employment after second birth, but at different times. It is not unlikely that those who work shortly after birth are those who have jobs which are easily combined with the maternity obligations, or who have relatively good access to child care facilities. On the other hand, some of the women who are not employed the year after the second birth may have a very strong work commitment, but find it impossible to re-enter the work force because of inadequate alternative child care. We also mention that some may have resumed their work activity because they already are pregnant and want to take advantage of the maternity leave system. In Norway a very small sum is granted to the non-employed compared to those who have worked extensively the last months prior to childbirth (Norges Offentlige Utredninger, 1987). The timing pattern of the third births does not give convincing support to this

explanation, however.

In the population of women included in our study only a fairly small proportion reported to be employed one year after second birth (between 1 November 1969 and 1 November 1970, or between 1 November 1979 and 1 November 1980). The proportion in part-time employment (100-999 hours, which may, of course, correspond to full-time employment during part of the year) was 10 per cent in 1970 and 27 per cent in 1980, while the proportion in full-time employment (more than 1000 hours) was 8 per cent and 11 per cent, respectively. This also confirms Ellingsæter and Iversen's conclusion that part-time work has become gradually more common.

As a side-step we refer to tables 5.9 and 5.10, which show the effects of some sociodemographic factors on the probability of working part-time or full-time a year after the second birth. We note the large positive effect of the woman's education, the large positive effect of the woman's age for full-time employment, and the negative effect of husband's relative income and education. These results agree fairly well with those obtained by Ljones (1979) in a study of female labour activity in Norway. Also a long interbirth interval, which indicates that the first child is more than 5 years old at the time of the census, is associated with a high proportion in full-time employment. Place of residence is another variable that appears to be related to the labour force participation, though the relation is much weaker than that between fertility and place of residence. The full-time probabilities are particularly large in Middle and Northern Norway. This is most prominent for women with low education (according to tables not published). Among those with very high education the full-time probabilities are largest in Eastern Norway.

5.6.3 Expectations based on previous theoretical and empirical research

In this section we briefly review some investigations that have shed light on the effect of labour force participation on fertility, and some basic theoretical contributions. The theoretical discussions of this issue tend to be very confusing, as there are a variety of approaches. Concepts like opportunity costs, double work load, sex role orientation, and work motivation are crucial in the public and scholarly debate, but the behaviour is seldom described with reference to all these concepts simultaneously. We also think that the economic-demographic theories, which would be a reasonable starting-point for more encompassing theories, are less developed with respect to female labour force participation than family income. The theoretical review below is simply an attempt to present the most common views, or our own interpretation of these views, in a relatively systematical way.

A crucial issue is the compatibility between the roles of the woman as mother and worker, as these roles place competing demands on the woman's limited supply of time. In contemporary Norway, as in several other industrialized countries, it is possible for women who have a fairly strong labour force commitment to bear children and care for them. A combination strategy may be based on part-time employment (see e.g. Bernhardt, 1988), use of child care facilities if they are considered satisfactory for the children (see e.g. Mason, 1987), assistance from adult relatives, or a temporary departure from paid work.

In principle, the couple is faced with the problem of deciding both the extent of their labour force participation, which is normally full-time for the

Table 5.9 Parameter estimates with standard errors in logistic regression models for the probability of part-time labour force participation[1]). Married women[2])

		Second birth 1969		Second birth 1979	
WOMAN'S AGE	20-22	-0.12	(0.09)	-0.22	(0.08)
	* 23-25	0		0	
	26-28	0.15	(0.07)	0.19	(0.05)
	29-31	0.00	(0.09)	0.11	(0.06)
	32-34	-0.25	(0.13)	0.15	(0.08)
AGE DIFFERENCE BETWEEN SPOUSES	Husband more than 6 ys. older	-0.02	(0.08)	-0.16	(0.07)
	* Husband 3-5 ys. older	0		0	
	Husband 0-2 ys. older	0.08	(0.07)	-0.07	(0.05)
	Woman older	0.05	(0.10)	-0.04	(0.07)
INTERVAL BETWEEN 1. AND 2. BIRTH	0-23 months	0.00	(0.06)	-0.07	(0.06)
	* 24-47 months	0		0	
	48+ months	0.02	(0.08)	0.14	(0.05)
WOMAN'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	0.28	(0.07)	0.28	(0.05)
	11-12 ys. school attendance	1.11	(0.09)	0.52	(0.07)
	13-14 ys. school attendance	1.17	(0.11)	0.98	(0.07)
	15+ ys. school attendance	1.70	(0.18)	0.75	(0.09)
HUSBAND'S EDUCATION	* 7- 9 ys. school attendance	0		0	
	10 ys. school attendance	0.02	(0.08)	0.05	(0.06)
	11-12 ys. school attendance	-0.03	(0.09)	0.12	(0.06)
	13-14 ys. school attendance	-0.06	(0.14)	0.19	(0.08)
	15-16 ys. school attendance	-0.34	(0.19)	0.19	(0.11)
	17+ ys. school attendance	-0.25	(0.16)	-0.12	(0.10)
HUSBAND'S OCCUPATION	Technical, scientific work	-0.11	(0.14)	-0.19	(0.08)
	Medical work	0.30	(0.22)	0.17	(0.14)
	Pedagogical work	0.28	(0.15)	0.21	(0.10)
	Administration	-0.09	(0.16)	0.04	(0.09)
	Clerical work	0.11	(0.13)	0.17	(0.10)
	Sales work, commerce	0.35	(0.11)	0.17	(0.08)
	Agriculture	1.59	(0.10)	0.32	(0.09)
	Transport, communications	-0.31	(0.12)	0.03	(0.08)
	* Industry, craft	0		0	
	Other occupations	0.07	(0.12)	-0.20	(0.08)
HUSBAND'S RELATIVE INCOME	-0.75	0.10	(0.10)	0.03	(0.07)
	0.76-0.90	0.02	(0.10)	0.15	(0.06)
	* 0.91-1.00	0		0	
	1.01-1.10	-0.07	(0.10)	-0.05	(0.06)
	1.11-1.25	-0.08	(0.10)	-0.31	(0.07)
	1.25+	-0.32	(0.10)	-0.32	(0.07)
PLACE OF RESIDENCE	East, non-rural	0.15	(0.10)	0.00	(0.08)
	* East, rural	0		0	
	South and West, non-rural	0.08	(0.11)	0.01	(0.08)
	South and West, rural	0.26	(0.11)	0.03	(0.09)
	Middle and North, non-rural	-0.07	(0.12)	0.25	(0.08)
	Middle and North, rural	0.01	(0.13)	0.17	(0.10)

cont.

Table 5.9 cont.

		Second birth 1969		Second birth 1979	
PARENTS' EDUCATION	Not living with parents, or education unknown	0.11	(0.10)	0.08	(0.59)
	* 7- 9 years school attendance	0		0	
	10-12 years school attendance	0.13	(0.11)	0.05	(0.07)
	13+ years school attendance	-0.12	(0.16)	-0.14	(0.11)
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0		0	
	Both spouses members of another religious society	0.27	(0.20)	-0.03	(0.14)
	None of the spouses members of a religious society	0.02	(0.36)	-0.32	(0.14)
	All other combinations	0.18	(0.11)	-0.16	(0.07)
CONSTANT TERM		-2.81	(0.12)	-1.53	(0.09)

* Baseline group
1) During 1 Nov. 1969 to 1 Nov. 1970 or 1 Nov. 1979 to 1 Nov. 1980
2) See note table 5.1

husband, and whether they should have a child (or an additional child). The sequence of decisions is a matter of uncertainty (cfr. the problem of causality referred to above). Moreover, we emphasize that among some groups there may be a normative pressure that restricts possibilities for individual decision-making. What we have in mind is the notion that it is principally unacceptable to combine paid work with responsibility for small children, partly because it may be harmful for the children. In a brief review of this literature Sweet (1981) refers the view that "other roles are considered appropriate only to the extent that they do not interfere in any appreciable way with the spousal and maternal role". We are inclined to believe that a normative pressure in this direction has weakened considerably in Norway during the last couple of decades. The prevailing attitude is probably that a combination strategy is totally acceptable and even recommendable.

Certain costs are associated with having an additional child. For a woman who has to quit labour force for some period of time in order to care for a small child, there is a loss of social rewards associated with the worker role as well as an economic loss.

From a sociological point of view it is argued that the preferences for motherhood versus employment are based on the woman's general role orientation, and that economic as well as social and psychological rewards are important. For instance, Kupinsky (quoted in Sweet, 1981) writes that "the more modern, instrumental and individualistic her sex role orientation, the more likely a woman is to perceive the economic and psychic benefits of working as greater than the economic and psychic benefits of having and rearing children, and thus to be more stongly committed to her worker role and to restrict her family size". For further references see Sweet (1981) and Bernhardt (1989).

Table 5.10 Parameter estimates with standard errors in logistic regression models for the probability of full-time labour force participation[1]). Married women[2])

			Second birth 1969		Second birth 1979	
WOMAN'S AGE		20-22	-0.32	(0.12)	-0.15	(0.08)
	*	23-25	0		0	
		26-28	0.23	(0.09)	0.31	(0.05)
		29-31	0.14	(0.10)	0.50	(0.06)
		32-34	0.26	(0.13)	0.70	(0.08)
AGE DIFFERENCE BETWEEN SPOUSES		Husband more than 6 ys. older	-0.05	(0.10)	0.23	(0.10)
	*	Husband 3-5 ys. older	0		0	
		Husband 0-2 ys. older	0.01	(0.08)	0.17	(0.07)
		Woman older	0.18	(0.11)	0.10	(0.10)
INTERVAL BETWEEN 1. AND 2. BIRTH		0-23 months	-0.14	(0.08)	-0.01	(0.10)
	*	24-47 months	0		0	
		48+ months	0.39	(0.09)	0.49	(0.07)
WOMAN'S EDUCATION	*	7- 9 ys. school attendance	0		0	
		10 ys. school attendance	1.07	(0.09)	0.35	(0.09)
		11-12 ys. school attendance	1.62	(0.11)	0.76	(0.10)
		13-14 ys. school attendance	2.85	(0.11)	1.29	(0.10)
		15+ ys. school attendance	3.69	(0.18)	2.14	(0.12)
HUSBAND'S EDUCATION	*	7- 9 ys. school attendance	0		0	
		10 ys. school attendance	-0.11	(0.10)	0.05	(0.09)
		11-12 ys. school attendance	-0.23	(0.11)	-0.19	(0.10)
		13-14 ys. school attendance	-0.22	(0.15)	-0.27	(0.12)
		15-16 ys. school attendance	-0.51	(0.19)	-0.64	(0.16)
		17+ ys. school attendance	-0.98	(0.17)	-0.63	(0.14)
HUSBAND'S OCCUPATION		Technical, scientific work	-0.18	(0.15)	0.35	(0.12)
		Medical work	0.18	(0.24)	0.32	(0.19)
		Pedagogical work	0.71	(0.15)	1.02	(0.13)
		Administration	0.13	(0.17)	0.34	(0.13)
		Clerical work	0.01	(0.15)	0.39	(0.15)
		Sales work, commerce	-0.06	(0.13)	0.26	(0.13)
		Agriculture	0.46	(0.14)	1.29	(0.12)
		Transport, communications	-0.06	(0.13)	0.01	(0.14)
	*	Industry, craft	0		0	
		Other occupations	0.35	(0.13)	0.10	(0.12)
HUSBAND'S RELATIVE INCOME		-0.75	0.63	(0.11)	0.54	(0.10)
		0.76-0.90	0.17	(0.11)	0.12	(0.09)
	*	0.91-1.00	0		0	
		1.01-1.10	-0.26	(0.12)	-0.19	(0.10)
		1.11-1.25	-0.44	(0.12)	-0.34	(0.11)
		1.25+	-0.71	(0.12)	-0.37	(0.11)
PLACE OF RESIDENCE		East, non-rural	0.12	(0.12)	0.28	(0.11)
	*	East, rural	0		0	
		South and West, non-rural	-0.01	(0.13)	0.03	(0.12)
		South and West, rural	-0.15	(0.15)	-0.18	(0.14)
		Middle and North, non-rural	0.59	(0.13)	0.37	(0.12)
		Middle and North, rural	0.27	(0.15)	0.23	(0.14)

cont.

Table 5.10 cont.

		Second birth 1969		Second birth 1979	
PARENTS' EDUCATION	Not living with parents, or education unknown	0.27	(0.11)	0.50	(0.79)
	* 7- 9 years school attendance	0		0	
	10-12 years school attendance	-0.13	(0.13)	-0.04	(0.10)
	13+ years school attendance	-0.11	(0.17)	0.30	(0.13)
RELIGIOUS DENOMINATION	* Both spouses members of the Norwegian Church	0		0	
	Both spouses members of another religious society	-0.27	(0.28)	-0.34	(0.23)
	None of the spouses members of a religious society	0.10	(0.34)	0.72	(0.15)
	All other combinations	-0.01	(0.13)	0.31	(0.09)
CONSTANT TERM		-3.61	(0.15)	-3.75	(0.15)

* Baseline group
1) During 1 Nov. 1969 to 1 Nov. 1970 or 1 Nov. 1979 to 1 Nov. 1980
2) See note table 5.1

In the economic theory tradition the emphasis is on direct costs and opportunity costs associated with childbearing. The direct costs refer to child care facilities, food, clothes, education and other marginal expenses due to an additional child, whereas the opportunity cost is the income lost by the mother. Mincer (1963) is reckoned as one of the first who stressed the importance of the opportunity cost in economic fertility models. The opportunity cost has two components. Firstly, there is often a reduction of the number of hours worked when the children are small, and consequently a loss of income (Cramer, 1979; Calhoun and Espenshade,1988). Secondly, the labour market experience is reduced, which in turn tends to give the woman a long term loss of income as well (Joshi, 1987). However, not all women have to quit the labour force or reduce the number of hours worked due to childbearing. Child care can be bought, or there may be relatives who can assist. Then the opportunity cost is turned into a direct cost. Moreover, it is important to keep in mind that the cost and availability of child care as well as the convenience of jobs may vary from region to region (Stolzenberg and Waite, 1984) and between other groups and individuals.

Another important point that we want to stress is that the work-fertility decision may be influenced by previous employment through either changes of the preferences in the direction of further labour force activity or because the woman's employment gives her more power in the "family negotiations" (see a brief review by Weller, 1977).

We also add that women in some professions may be very exhausted after work and feel that the the burdens of child care during the evening, and perhaps the night, are particularly heavy. This may be an important contribution to the perceived role incompatibility. However, it is far from evident that women who are homemakers generally have more energy left at the end of the usual working-time than the employed mothers. Another burden that the employed women may be

faced with, and which is relevant to take into account in the context of further reproduction among two-child mothers, is the marginal household work due to a third child. This work must be done after the usual working-hours, while the homemakers can take at least part of it earlier in the day, unless the children are too demanding. This kind of double work load for the employed is an additional source of role incompatibility.

In view of the above discussion of roles and costs one might expect women who are more strongly committed to their worker role to have fewer children than those with a less pronounced work orientation. It is important to be aware, however, that when economic factors are considered, not only the potential income loss due to an additional child is essential. What we have in mind is that the families in which the woman has paid work, tend to have the highest total income (other covariates kept fixed). This would offset the negative opportunity cost effect. To illustrate this, let us consider the two extreme cases of one woman who has worked extensively in the past and plan to be in the work force almost unabruptedly until the retiring age, and another who has always been a homemaker and will remain so regardless of subsequent reproduction. The family of the first woman has a higher total income (with other covariates fixed), which according to the "Becker school" may have a positive effect on fertility. However, if the couple has adapted their consumption and aspirations to a dual-earner economy, a drop in income due to the mother's temporary reduction of labour force activity may be most unwelcome and affect fertility negatively. For the second woman, however, there are no opportunity costs, and, if we assume that there is a certain adaption to a long-term income level, the direct costs of an additional child may be almost equally easy to manage. In other words, it is not unlikely that a higher permanent income has a small effect on fertility, and a potential drop a clear negative effect. In this context it should also be emphasized that the extra income gained by the dual-earner couple may be fairly small if child care expenses for the first and second child are subtracted. Moreover, we mention that with current kindergarten prices a large proportion of two-child mothers provide a net contribution to the family economy that is smaller than the child care expenses for a potential third child, so that further reproduction leads to a more long-lasting withdrawal from the labour force, unless they for some reasons prefer to work in spite of the deficit. These points do, of course, not alter the main arguments about costs of childbearing, but illustrate the sizes of the budget components involved.

Another factor that may be important to take into account in such economic-demographic arguments is the motivation for female employment, as also stressed by Ware (1976). If the woman has to work because of a strained family economy, the costs of an additional childbirth may be particularly hard to bear, and the fertility consequently very low compared to that of other women. The opposite also seems plausible, however. Women from the lower social classes, who tend to be economically disadvantaged, and thus may be forced to work, may also have an inefficient use of contraception. Jones (1981) has referred to this as the "poverty syndrom" in an attempt to explain a positive relation between employment and fertility.

An inspection of the interaction between labour force participation and husband's income, and the interaction between labour force participation and woman's education, might give an idea of how work motivation influences the

relation between employment and fertility, but there is also reason to emphasize that the pressure to work may derive from factors not necessarily correlated with income and education. For instance, previous consumption and investments may influence the current economic strength just as much as the income level.

We also add that the opportunity costs differ with educational level of the woman and her labour force experience. A woman with a high earning potential has more to lose in connection with a childbirth, but may also be more able to afford the losses. Besides, the importance of her income for the total family economy depends on the size of her (potential) income compared to that of the husband. This serves as further justification for studying the interactions involving education and husband's income.

Let us turn to a brief review of previous empirical reasearch. Cramer (1980) has found a negative impact of gainful employment on fertility. He argues that this is basically a long-term effect, whereas the impact in the opposite direction is a short-term effect.

With Norwegian data Jensen and Schweder (1988) have found that limited interbirth employment has no significant effect on second birth intensities, whereas extensive employment has a considerable impact. Due to limitations of the data their evidence may not be entirely conclusive, however.

Some investigations that focus on the transition from second to third child in particular, suggest a negative effect of work-force participation. For instance, Ware (1976) observed a negative, but very small, effect on fertility desires among two-child mothers when she compared those who had worked continuously since marriage and those who had never worked since marriage. With support from American material Jones (1981) asserted that "after having two or more children taking a job was likely to be associated with the decision to give up further births originally intended". We also refer to Brunborg (1984), who has found no significant differences in attitudes towards further childbearing between employed and non-employed two-child mothers in Norway (but a positive parameter for the employed). The empirical evidence from our neighbouring country, Sweden, points in different directions. Hoem and Hoem (1989) have found that in a given month subsequent to second birth the employment status has a substantial negative effect on conceptions the same month. The effect is diminishing across cohorts. Moreover, they have found that fertility expectations are negatively influenced by employment at interview time, though only for women with low education (Hoem, 1989). However, there turns out to be no significant differences in third birth intensities between women who have had gainful employment during most of the interval between first and second birth and those who have been primarily homemakers. Taking a job after having been a housewife for a long period is associated with a particularly low fertility, though. The British study, which is very similar, supports the Swedish conclusion that accumulated labour force experience has a surprisingly small influence (Wright et al., 1988).

5.6.4 Empirical conclusion

With our data we have found small negative parameters corresponding to full-time employment both for women with a second birth in 1969 and those with a second birth in 1979, but the effect is only significant for the former group.

We have also estimated some models for the probability of having a third birth within 6 years among women with a second birth in 1968 or 1978. The labour force participation in 1969-1970 and 1979-1980 was, of course, higher than that found among women with a second birth in 1969 or 1979. Among the women who had a second child in 1968 13 per cent worked less than 999 hours, and 9 per cent worked full time. Among those with a birth in 1978 the corresponding figures were 31 and 15 per cent. We found a significant negative effect of full-time work for those with births in 1978 (-0.22) and no effect for those with births in 1968 (-0.05).

All in all, our results indicate that there is a negative, but very small, effect of full-time employment and no effect of part-time employment. We cannot say with certainty whether the effect has changed over time. Our main model indicates such a development, but it is not supported by our findings for the women with a second birth in 1968 or 1978.

We have referred to theory that suggests important interactions between employment status and husband's income or woman's education - partly because the motivation for work may be a crucial determinant. It turns out, however, that the pattern is the same regardless of the values of these two variables. The only exception is that there is a particularly large negative effect of full-time employment for women with 13-14 years school attendance who had their second birth in 1979. Moreover, we have found that there is a similar effect of labour force participation in all parts of the country, in spite of different job and child care markets.

It is very difficult to interpret the weak effects we have observed. As referred to in section 5.6.3, the arrival of an additional child for a two-child mother with a strong work commitment who wants or needs extensive labour force activity in the future, entails certain economic and non-economic losses. These losses are not relevant to take into account for the few women who are homemakers and plan to remain so regardless of subsequent fertility. Unfortunately, our labour force variable does not capture well enough the real work orientation, and we know very little about the size of the losses involved, and the extent to which they are offset by the economic advantages that a dual-earner family has.

To be more specific, let us briefly repeat what the labour force activity the year after the second birth may indicate, and discuss the possible effects on subsequent fertility: Those who have gainful employment in this period, have felt some desire or need for work, and may have jobs that are relatively easily combined with the obligations of parenthood, or may have good access to kindergartens or other child care facilities. These women have some losses in connection with an additional birth, and the implications of and size of these may depend on their work motivation, the family's economic strength etc. As argued previously, the negative effect of a drop in income is offset by a high long-term income level compared to those who have favoured a more traditional division of labour, so the total impact on fertility is by no means obvious.

Among the women who are homemakers the year after the second birth, there may be a large proportion who are just as strongly work-oriented as those described above, but who have not found adequate child care arrangements. Assuming that this will be a problem for them also in connection with future childbirths, they will be faced with particularly large losses, and are likely

to have low subsequent fertility.

The other group of women who are homemakers the year after the second birth, are those with a very modest work commitment. If they are totally uninterested in gainful employment or unable to obtain it, the losses repeatedly referred to are not relevant. If they have deliberately planned to take care of their second child for a few years before entering the work force, they may have a relatively good economic situation, and be able to afford the losses caused by a third child. However, it is not unlikely that the family has chosen to have a relatively low total income as long as the second child is very young, and that they rely heavily on a dual-earner economy in the future.

There are, undoubtedly, several alternative links between our labour force variable and subsequent fertility, but we have at least demonstrated the complexity.

We would like to terminate this discussion with a reference to two main interpretations of the weak effects we have estimated: Firstly, it is a possibility that the economic, social and emotional losses associated with a reduction of the labour force activity, or the losses associated with the use of child care facilities, actually are considered relatively small in Norway - not least because they are partly offset by the higher income that the dual-earner couples have compared to those who have preferred a more traditional division of labour. The second explanation is that our variable is inadequate as an indicator of the underlying preferences and employment strategies. In particular, the fertility in the non-employed category will be low, and that in the employed category comparatively high, if a large proportion of those who are homemakers the year after the second birth have a strong work commitment but have not managed to find adequate child care arrangements.

Evidently, with the present data we cannot draw very firm conclusions with respect to the interconnection between employment and fertility, but our results serve to throw some doubt on the idea that strong commitment to the worker role exerts a negative influence on fertility - at least for women who have already had two children.

5.7 The woman's occupation

The effect on the third birth probabilities of woman's occupation the year after second birth is assessed in models comprising women in gainful employment exclusively (tables 5.6 and 5.7).

Our framework provides us with estimated effects of occupation on subsequent fertility, while the previous analysis of cohort fertility (Kravdal, 1989) was based on the total number of children at a particular age and the occupation 4 years earlier. Consequently, the present investigation invites us more strongly to interpret the results as a causal effect of occupation on fertility, though we urge to admit that expectations about future fertility may influence the choice of occupations. Besides, in the analysis of third births there is a control for income and labour force participation, which gives us a more "pure" occupation effect.

Women employed within agriculture have significantly higher subsequent fertility than those employed in the industry. Also medical work is associated with high fertility, but only for the group of women delivering their second child in 1969. Clerical work, sales work, pedagogical work and technical or

scientific work is negatively related to the third birth probabilities for at least one of the two groups of women (with a second birth either in 1969 or in 1979). None of these parameters are significantly different from 0, however. Note that the positive effect of teaching, which was found for total cohort fertility, disappears when third birth probabilities are modelled and several controls are included.

Kiser et al. (1968) and Cho et al. (1971) have observed a high fertility for nurses and low fertility for secretaries in US data from 1960. In a more recent work O'Connell and Rogers (1982) have found that sales and clerical workers and professionals tend to have few children, while those working on a farm have large families. These results, which refer to total period or cohort fertility, are consistent with our estimates obtained in models of third birth probabilities.

One explanation of the positive effects is that the combination of employment and family life is somewhat more easy for nurses, who have fairly good access to kindergartens, and for those working on a farm. Moreover, psychological factors may play a certain role. For instance, it is possible that women who perform care functions professionally, feel the burdens of child care less problematic, but we will refrain form going into further speculations in such directions.

5.8 The husband's occupation

When we consider the effects of husband's occupation according to models comprising all married women (table 5.1) we find almost the same structure as for the woman's occupation. Agricultural work is associated with high third birth probabilities. Also medical work is positively related to fertility (the parameter is almost significantly different from 0 for women with second births in 1979). For those having a second birth in 1969 there is a significant negative effect of sales work, and a negative effect (parameter almost significantly different from 0) of clerical work.

If we instead focus only on couples where the woman is employed (tables 5.6 and 5.7) the picture is more obscure, except that fertility appears to be particularly high when the husband is working in the agricultural sector.

As commented in section 5.6, the relative income is not the ideal income variable if we intend to "explain" educational or occupational fertility differentials. It turns out, however, that inclusion of actual income instead of relative income in the models does not change the estimated effects of occupation (table 5.3).

The results agree well with those obtained for total cumulated fertility (Kravdal, 1989), except that the estimates presented in this report suggest a more negative effect of sales work. The small group of men with religious work, who were found to have a particularly high total fertility, is not a separate category in the present analysis.

Without plunging into the details we briefly state that our empirical results agree well with those reported by Kiser et al. (1968), Cho et al. (1971) and Rindfuss and Sweet (1978) for total cohort or period fertility.

5.9 The woman's income

Since we do not know the exact number of hours worked (see chapter 2), the effect of the woman's income is not worth a very detailed investigation. We believe, however, that variation in total income is not entirely due to differences in labour force participation, but partly reflect variation in the wages during the actual period and the potential earning power the following years.

We have experimented with different categories, and the pattern appears to be fairly irregular, except that women with no income have particularly high fertility (tables 5.6 and 5.7). This is most clearly seen in models where the occupation is not included, as those who have no registered income to a very large extent have agricultural work. (Actually, 95 per cent of the women who had a second birth in 1969, and reported in 1970 that they worked more than 100 hours in the agricultural sector, had no net income according to the tax authorities. The corresponding proportion for women with a birth in 1979 was 32 per cent.) If we disregard the 0-income group there is no significant effect of having low or high income compared to having medium income.

According to economic theory there is a mixed effect of woman's income. It is contended (see e.g. Mincer, 1963; Willis, 1973) that women with a higher potential income have more to lose (in an economic sense) in connection with a childbirth, as an exit from the labour force has a higher price the higher the income. On the other hand, the female income contributes to the total family income, which is traditionally believed to be positively related to fertility (see section 5.10). This positive income effect may in principle outweigh the so-called substitution effect, but Mincer (1963) and other scholars have found that the total effect of the woman's income is negative. We also refer to a Norwegian study (Brunborg, 1984), which showed that there was no significant effect of the woman's potential income on the attitudes towards further childbearing among two-child mothers (but a negative parameter).

With our data, in which a negative effect of the husband's income shows up, we would expect the woman's income to exert a negative influence on fertility. We believe that this inconsistency between results and expectations is primarily due to the weak relation between our income variable and the woman's real earning power.

Moreover, we mention that there is a consistent pattern in our results, as all the three economic variables, husband's income, woman's income, and labour force participation, are only weakly related to the third birth fertility.

5.10 The husband's income

5.10.1 Brief review of previous theoretical and empirical research

Much attention has been devoted to studies of the association between income and fertility, not least because income is a factor that to some extent can be influenced by political decisions.

In previous centuries and a large part of this century an inverse relationship between fertility and husband's income or family income has been found - at least when the analysis has been confined to univariate models. This is usually taken to reflect differences in social class norms, the role of the

woman, knowledge about contraception etc.

A great deal of research was carried out in the 1960s and the 1970s. In an influential work Becker (1960) asserted that there might be a positive income effect, net of the confounding effect of differences in contraceptive knowledge, as the demand for children as a "consumption good" would be likely to increase with increasing family income. On the other hand, he has suggested that couples want to increase both quantity and "quality" of children and that improved economic conditions may result in higher investment in each child rather than more children.

Becker's ideas have met with considerable criticism, not least the "quality" aspect. For instance, Duesenberry (1960), Blake (1968) and Turchi (1975) have emphasized that the parents are not free to choose the "quality" level. It is determined mostly by the parents' own standard of living and that of their nearest social contacts.

Also the concept of "tastes", i.e. individual preferences for "quality" versus "quantity" of children, for investment in children versus investment in other "goods", for familial versus non-familial activities etc., has received much attention. A particularly important point, which has also been noted by Becker, is that the tastes may vary with income. Moreover, Easterlin (1969) has referred to the importance of education, place of residence, childhood experiences and other factors in the shaping of tastes, while Leibenstein (1975) has argued that the tastes to a large extent are determined by the "social influence group".

The empirical findings in studies of the association between income and fertility are fairly diverse. Thornton and Freedman (1982) conclude that there is little support for a positive income effect - both according to previous investigations and according to their own analysis. They have found, however, a small positive effect for transitions from parity 2 to parity 3.

There are also other examples of a positive income effect. Cho (1968) observed a small positive effect of husband's income, and Freedman (1963) a positive effect of husband's relative income. To control for differences in contraceptive knowledge and socially influenced "tastes" and "quality" requirements, she recommended the use of relative income. Her work demonstrates that the empirical conclusion is substantially changed when she substitutes the actual income with the income relative to that expected on the basis of age, education and occupation. Also Bean and Woods (1974) have provided a good example of the importance of controlling for such factors. In a recent work based on Korean data Borg (1989) contends that controls for some child quality variables (expected cost of college, expected education for daughters, special lessons for children) and other net price variables (e.g., expectations about help with farm work) are necessary to obtain a positive effect of husband's income.

Another investigation that we refer is that by Thornton (1978), in which it is concluded that income (measured as actual, relative or subjective relative) was positively related to the number of children ever born, but that it had no effect on expected subsequent fertility. Bean et al. (1978) found a positive effect on wanted fertility and a negative effect on unwanted fertility.

Several authors emphasize the importance of interactions. Bernhardt (1972) and Seiver (1978) have found that income has a negative effect on subsequent fertility at high parities and a positive effect at low parities. Also

Namboodiri (1974) and Hout (1978) concluded that the importance of income depends on parity, whereas Simon (1975) points to an important interaction with educational level.

We also refer to a Norwegian study showing that there was no significant effect of income on the attitudes towards further childbearing among two-child mothers (but a negative parameter) (Brunborg, 1984).

Finally, we mention a recent work by Caldwell et al. (1988), where it is stated that the repondents in an Australian survey often give economic reasons for cessation of childbearing.

5.10.2 The relative income concept

The time-horizon involved in a decision-making and the extent to which economic considerations have a bearing on reproductive behaviour varies considerably from person to person, but many couples probably compare the costs of an additional child during at least the first few years of its life with other costs and with the income during that period. Consequently, a relevant income variable in the context of fertility would be potential income. Easterlin (1969) is one of those who have stressed the relevance of this variable. In some investigations potential income is predicted from other sociodemographic variables and included in the models (see e.g. Hout, 1978; Brunborg, 1984).

The actual income during a particular year, which we have access to, may in principle not be well correlated with income in other stages of life. For instance, a low income might be due to a reduction of the number of hours worked that particular year for different reasons. (The wife may have increased her labour market activity temporarily, the husband may have taken further education etc.) In such a case the lower income is not a signal of low income for the husband during the years in which a third child places the most heavy demands on the family economy. Access to information on the number of hours worked, and thus the wage rate, would have been preferable, but nevertheless we believe that the actual income is an acceptable proxy for income earned by the husband in the actual period.

Most of our models are based on the relative income, which was recommended by Freedman (1963). It is defined as actual income divided by expected income, where the expected income is predicted from estimated parameters in a regression model containing the age, education and occupation of the husband (see table 5.11). We add, though, that since our analysis is based on multivariate regression, the use of actual income in models where age, education and occuaption are controlled, leads to the same conclusions as the use of relative income. The main reason why relative income is preferred is that with fixed categories for actual income very few have low income in the groups with high education, and very few have high income in the groups with low education (similarly for age and occupation). This makes studies of interactions between income and, say, education less meaningful. With our definition of relative income categories, 10-20 per cent within each social group have very low income, and a similar proportion have very high income.

The idea of using actual income with controls for socioeconomic factors or, alternatively, relative income is that the norms and preferences related to childbearing, the cost of children (to obtain a "quality" partly determined by social class), and the knowledge and use of contraception are likely to differ

by social group. When this variation is controlled a more "pure" income effect remains, and this allows for a better assessment of the effect of improving the economic condition for the families, through for instance a political initiative.

Table 5.11 Parameter estimates in OLS linear regression models for husband's income[1])

	1970	1980
Intercept	-10.837	30.986
Husband's age	2.365	2.656
(husband's age)^2	-0.031	-0.023
Husband's education		
* 7- 9 years school attendance	0	0
10 years school attendance	3.186	3.901
11-12 years school attendance	2.626	3.106
13-14 years school attendance	5.194	7.835
15-16 years school attendance	8.777	15.360
17+ years school attendance	15.287	29.893
Husband's occupation		
Technical, scientific work	0.718	4.757
Medical work	8.185	15.868
Pedagogical work	-2.790	-13.071
Administration	6.280	11.833
Clerical work	1.601	0.774
Sales work, commerce	1.826	1.104
Agriculture	-5.889	-19.110
Transport, communications	2.443	4.861
* Industry, craft	0	0
Other occupations	-0.583	-1.661

* Baseline group
[1]) In 1000 Nok

The effects of relative income are not sensitive to the omission of the occupation variable, as that variable is already incorporated into the relative income variable (through the linear regression model to produce the latter), but it turns out that place of residence "explains" part of the relative income effect obtained in more simple models. We have found that 8 per cent of the husbands living in non-rural areas of Eastern Norway have a low relative income (less than 0.75), whereas this proportion is 35 per cent in the rural areas of Middle and Northern Norway (among women with a second birth in 1969). This suggests that future studies of income and fertility in Norway perhaps should be based on a relative income concept where place of residence is taken into account along with age, education and occupation.

It should be added that although relative income is a very useful concept for studies of the direct effect on fertility of the family economy, it is not well suited when the objective is to see whether income differentials can

explain other observed differentials. This is why some models are run with actual income as a regressor instead of relative income.

5.10.3 Results

The average actual income for husbands included in our 1969 sample is about 34000 NOK. 15 per cent earn less than 25000 (25 per cent below average) and 19 per cent more than 42000 (25 per cent beyond average). For the 1979 sample the average is 95000, 12 per cent earn less than 70000, and 16 per cent more than 120000.

The results obtained in regression models where relative income is included are shown in tables 5.1 and 5.2. It appears that for women having a second birth in 1969 or 1979 those whose husbands earned less than 90 per cent of the expected, had significantly higher third birth probabilities than those whose husbands earned 0.90-1.00 times the expected. There is no difference in fertility between this mid-group and those who had an income higher than expected.

Models including actual income also give an impression of high fertility if the husband has a low earning power (table 5.3).

The interactions between relative income and other sociodemographic variables are tested, but none of them modify the main empirical conclusions. By and large, there is a positive effect of low income and no effect of high income in all educational and regional groups. There are some differences, though. For instance, the significant interaction between the woman's education and the husband's relative income (see table 5.4) reveals that there is no effect of low income for women who gave birth in 1969 and who had 10 years of school attendance. The interaction between female labour force participation and husband's income (which did not significantly improve the model fit) indicates that the effect of income is slightly smaller for employed wives than for those who are not employed. This also appears in the estimates in tables 5.6 and 5.7. When the woman's income and occupation are included as controls, there is a non-significant positive effect of low relative income and a non-significant negative effect of high relative income among couples having a second birth in 1979, and a very irregular pattern for those with a second birth in 1969. If we focus on the extreme groups for the latter couples, we find a non-significant positive effect of having relative income less than 0.75 (compared to having a relative income between 0.75 and 1.25), and a non-significant negative effect of having relative income higher than 1.25. In other words, the data for employed women suggest a negative income effect, as we found for all married women pooled together, but the conclusion rests on a much weaker platform.

5.10.4 Discussion

We cannot conclude from our analysis that economic considerations are of minor importance in the fertility decision for couples who already have two children. Also couples where the husband has a relatively high income may feel that they cannot afford to have an additional child, and that the economic conditions are the main inhibiting factor. Not only the income, but also the size of loans and savings, transmission of property from the parental generation

etc. are, of course, important determinants of the current economic strength. For instance, an economic pressure due to previous investments in, say, housing and previous consumption may have "trapped" the couple and impede a transition to parity three. Indeed, the association between income and perceived economic problems may even be negative. A higher income just after second birth, perhaps because of working over-time, which is fairly common in Norway among fathers with small children, may indicate a very strained family economy. The important lesson that can be learned from our analysis is that couples where the husband has a lower income, actually have a higher subsequent fertility, though one might perhaps tend to believe that they are faced with more severe economic problems.

These results have definite policy implications. There may be good reasons for allocating more economic resources to families with small children, but it is far form evident that this is going to affect their propensity of having a third child. According to our results, there are some reasons to believe that a higher economic level is more likely to result in higher consumption of other "goods", more investments in housing etc. However, one cannot rule out the possibility that a considerable general income rise over time may contribute to push the total cohort fertility up, even though there is a weakly negative association between income and further reproduction within a group of women having their second child the same year.

The explanation of our empirical finding is far from obvious. As the educational level is controlled (which did not have much effect anyway), we do not believe that the results are primarily manifestations of differences in contraceptive knowledge or use, though one cannot be sure. For instance, persons who are "planners" rather than more implusive decision-makers might tend to have both a high income and use contraception more efficiently. It is also a possibility that the negative income effect is caused by differential "quality" requirements, net of the variation in educational level, so that childbearing and childrearing are more expensive relative to other activities or consumer goods for the high income families than for the more economically disadvantaged. A more plausible explanation may be that differences in "tastes" have resulted both in stronger preferences for income-generating activities and a preference for fewer children.

5.11 Place of residence

Place of residence appears to be an important determinant of third birth probabilities also when several other controls are included. As a matter of fact, the other factors explain very little of the regional effect. It also appears that the effects estimates of the other factors are virtually insensitive to the omission of the regional variable. A large number of fertility studies presented in the literature disregard the spatial dimension. Our results indicate that this would be no harmful misspecification in Norway, but that a larger proportion of the variance is explained through the inclusion of place of residence. In fact, our significance tests show that no other variable has such a strong explanatory power (table 5.5). Place of residence may, of course, be less closely related to reproductive behaviour in other countries.

According to table 5.1 the third birth probabilities are lowest in the non-rural areas of Eastern Norway and highest in the rural areas of Southern and Western Norway. The regional structure is the same for women with births in 1969 as for women with births in 1979.

Several explanations may account for the regional differences. For instance, it is likely that the direct costs of having children are smaller in rural than in non-rural areas - at least the cost related to housing. Moreover, there may be a less abundant supply of leisure activities to compete with family life in the more sparsely populated parts of the country, and the priorities between familial and non-familial activities may differ from region to region - reflecting the differences in norms and values that also show up in other aspects of the demographic pattern (notably marital stability and pre-marital conceptions). For instance, the "traditional family values" apparently have much more support in the South and West, not least because of a stronger position of the Church. There are probably also regional differences in the opportunities for gainful employment, as well as in the compatibility between paid work and family obligations. Such factors may have an effect on fertility even though our labour force variable is only weakly related to the third birth probabilities.

We have access to information on change in place of residence between two censuses, but have not given priority to a study of the interconnection between migration and parity three transitions. (See Kravdal (1989) for an analysis of total cohort fertility and regional mobility.)

5.12 The education of the woman's parents

We also want to find out whether there is a direct effect of the parents' education, or whether the effect of social origin has eroded for women who have established their own family with four members, as reported by Hoem and Hoem (1989).

Table 5.1 reveals that among women with a second birth in 1969 there is a significant positive effect on the third birth probabilities of having parents with a high education, while for women with a second birth in 1979 there is a significant positive effects of a medium education.

A positive impact on fertility of taking education beyond a primary level was also found when we considered the total family size at age 39 (Kravdal, 1989).

There is no obvious explanation of this positive effect on the third birth probabilities. One might believe that parents from the higher social classes provide their children with an economic support that contributes positively to fertility, but this does not seem very likely, as the economic strength the couple has gained through the husband's income apparently is inversely related to fertility. Parents may also contribute through taking part in the child care, but this is not necessarily more common among the higher social classes. An inspection of social differences in labour force participation among middle-aged women and in the residential distance between the generations might give some answers.

5.13 Religious denomination

We expect that religious attitudes are strongly related to fertility. The

mechanism is probably that the individual preference structure is skewed towards familial activities for persons who are religiously active or who are affiliated to certain religious denominations. Moreover, the religiosity may affect the sex role ideals as well as the normative barriers associated with an induced abortion (Balakrishnan and Chen, 1988).

Unfortunately, our variable is only able to distinguish the large group of persons affiliated to the Norwegian Church from those who belong to other religious communities and those who are not members of any religious community.

It appears that the small number of couples in which both spouses are affiliated to religious denominations other than the Norwegian Church have particularly high third birth probabilities, while non-members have probabilities not differing significantly from the average (but with a negative parameter estimate). This corresponds well with what we have previously found for total cohort fertility (Kravdal, 1989). The couples who are members of other religious societies are probably a religiously active group. We would expect to find a high fertility also among religiously active within the Norwegian Church, but with our data we are unable to split these couples from the large number of "passive" members. In Brunborg's (1984) analysis based on the Norwegian 1977 Fertility Survey it was concluded that there is a significant positive relation between number of children ever born and religious activity, as measured by the number of religious meetings the respondent has attended per year.

5.14 Timing of first birth relative to marriage

One might expect previous demographic experiences to be associated with third birth probabilities - primarily because these experiences may serve as signals of fundamental family values or personality traits that change very slowly and influence the woman's decisions also during later stages of the life course. For instance, it seems plausible that women who have had a child before they marry have more "liberal" values than other women. Contraceptive knowledge and use may, of course, also differ, even though educational level is controlled in the model.

Unfortunately, the exact time at marriage is unknown for a large proportion of the women who had a second birth in 1969. These women were excluded from the analysis of the timing of first birth.

It appears that women with a pre-marital birth have significantly higher third birth probabilities than those who conceived their first child in marriage (table 5.12). Being pregnant at marriage, however, is associated with a significantly lower fertility. These results appear to us as fairly puzzling, and do not agree well with previous studies. Kravdal (1989) has found that the total cohort fertility (for married women who have at least one child, which is a vast majority) is particularly high both for women with a pre-marital birth and for those with a pre-marital conception.

5.15 Explaining the downward trend in fertility

In general, all the sociodemographic fertility determinants we have considered appear to have about the same effects for women with a second birth in 1969 as for those with a second birth in 1979 (table 5.1). Moreover, the

distribution of women over the different categories does not change much (table 2.1). This implies that the factors included in the study are unable to explain the decline in third birth fertility. The only exception is the spacing between first and second birth.

Table 5.12 Parameter estimates with standard errors in logistic regression models for the probability of having a third birth within 5 years after the second[1]). Married women[2])

First birth timing	Second birth 1969	Second birth 1979
First birth before marriage	0.35 (0.08)	0.26 (0.07)
First birth within 7 months of marriage	-0.15 (0.05)	-0.15 (0.05)
*First birth after 7 months of marriage	0	0

* Baseline group
1) Controlled for women's age and labour force participation, age difference between the spouses, woman's and husband's education, husband's relative income and occupation, place of residence, interval between first and second birth, and the education of the woman's parents
2) Women for whom we only know year of marriage are excluded. Otherwise the restrictions are as in footnote 1 table 5.1

The interbirth interval has changed markedly from 1969 to 1979. At a given age at second birth the average interval was about 7 months longer in 1979 than in 1969. This is also reflected by the proportions with intervals shorter than 2 years and longer than 4 years. These proportions were 34 and 20 per cent, respectively, in 1969, and 14 and 35 per cent in 1979. Such an increase in the second birth interval also appears in the appendix tables presented by Brunborg and Kravdal (1986). For instance, among women having their first births in 1964 or 1974 at age 24, 85-90 per cent have eventually had a second child. The proportion with a second child within 3 years, however, decreased from 55 per cent for first births in 1964 to 38 per cent for first births in 1974. (These figures are based on a total population of women, not only the married.)

We have estimated a few models comprising second births both in 1969 and 1979 (table 5.13), and have observed that the effect of historical time is slightly reduced when age at second birth is introduced, and much more reduced when also the spacing is introduced. (A continuous birth interval variable gives the same results.) Rather than an "explanation" this should probably be considered as a reflection of a simultaneous decision. The women have preferred to have both fewer children and a somewhat wider spacing. Actually, the causality may run in the opposite direction, from fertility (expectations) to interval length. When a small family is intended, a tight spacing is no necessity. Addition of more variables does not reduce the effect of historical

time further. On the contrary, there is a certain increase, mainly because a higher proportion of the births take place in Southern and Western Norway.

Table 5.13 Parameter estimates in logistic regression models for the probability of having a third birth within 5 years after the second. Married[1]) women

Year at second birth	Model 1	Model 2	Model 3	Model 4
* 1969	0	0	0	0
1979	-0.507	-0.424	-0.256	-0.342

* Baseline group
[1]) See note table 5.1

Model 1: Univariate model
Model 2: Age at second birth included as control
Model 3: Age at second birth and interbirth interval included as controls
Model 4: Age at second birth, interbirth interval, age difference between spouses, labour force participation of the woman, place of residence, education of both spouses, and occupation of the husband included as controls

6. SUMMARY AND CONCLUSION

6.1 Decline and stabilization of third birth probabilities

The objective of this analysis was to throw light on the decline of third birth progressions from the mid-1960s to the mid-1980s.

It appears that the probability of having a third child within 10 years after the second has decreased considerably during this period. If we restrict the observation interval to 5 years, however, a slight upturn is discerned for the women aged 20-24 at second birth, which has been a diminishing group, and for those living in non-rural areas. For all other age groups and regional groups the 5-year birth probabilities have levelled out or declined very moderately if we compare women with a second birth in 1974 and those with a second birth in 1979. A recent work by Prioux (1989) demonstrates that a stabilization of third birth fertility has been witnessed also in several other European countries.

The halting decline in third birth progressions goes hand in hand with the emergence of a positive education effect and a rise in the number of women taking more than compulsory education. Prior to 1975 there were no significant differences in third birth probabilities by educational level, except that the women with 10 years school attendance had relatively low fertility. Among women delivering their second child in the late 1970s, the third birth probabilities rise gradually with increasing educational level, in spite of the later entry into motherhood among those with high education. When we consider each age group separately, a positive effect of education appears more generally throughout the period under study.

The observed increase in fertility for a few groups of two-child mothers is an interesting signal that a crucial change might be in the offing, but until more recent data are available, and we gain more knowledge about the selection into parity two, we hesitate to speculate in the direction of an immediate "renaissance" for the three-child family.

6.2 Sociodemographic determinants of third births in the early 1970s and the early 1980s

A more detailed sociodemographic analysis of third birth probabilities has been carried out for women having their second births in 1969 or 1979, and for whom we know several socioeconomic characteristics the year after delivery. Among women having their second child in 1969, and who were 20-34 years old at that time, 40 per cent had a third child within 5 years. The corresponding proportion among women with a second birth in 1979 was 26 per cent.

The effects of the different sociodemographic determinants have been assessed by logistic regression models. The focus has been primarily on the probability of having a third birth within 5 years. Even among women who had their second child at the fairly early age of 25 in 1969, about 75 per cent of the third births occurred within 5 years. Model estimates based on 5-year probabilities are very similar to those based on 10-year probabilities.

Let us now briefly review the effects on the third birth progressions of the sociodemographic factors that we have considered. Evidently, the purely demographic variables explain a large part of the individual variation. The

third birth probabilities are inversely related to the woman's age at second birth and to the interval between first and second birth. The husband's age, however, plays only a minor role. Presumably, the demographic variables capture some of the heterogeneity in fecundity and contraceptive use, as well as in basic preferences and life strategies. Women who start childbearing early or have a short interbirth interval may be strongly oriented towards familial activities, may have planned a large family at an early stage, may use less efficient birth control methods etc.

Another purely demographic variable that we have considered, is the timing of first birth relative to marriage. We are somewhat surprised to find that having a child prior to marriage is associated with particularly high third birth probabilities, while pre-marital conceptions not resulting in an out-of-wedlock birth have the opposite effect.

When age and other factors are controlled, the women with high education have significantly higher third birth probabilities than those with only a compulsory education. This holds for 5- as well as 10-year intervals and among those with second births in 1969 as well as those with second births in 1979. For the latter group of women the net effect of educational attainment even outweighs the subduing effect of a higher age, so that there is a positive gross effect. In fact, among the women with a second birth in the late 1970s, 13 or more years of school attendance is associated with a particularly high fertility - in spite of the relatively late age at entry into motherhood.

Until more recent data are available, we cannot be entirely confident that this is a "quantum" phenomenon, and not only a quicker transition to a three-child family in the higher social strata. We also point out that within a birth cohort of women who have largely terminated childbearing, for instance those born in 1945, a positive effect of education on third birth probabilities is not yet found. However, it may, of course, show up in younger cohorts. Moreover, we emphasize that even if third birth probabilities should turn out to be positively related to education in some cohorts, the selectivity into parity two may contribute to preserve the usual pattern of a negative educational gradient in total cohort fertility.

It has taken us with some surprise that the direct effect of education on third births is so strongly positive. The data do not support the idea that it is due to a higher family income. A better explanation may be that the work-family incompatibility may be less pronounced among the women with a high education. Finally, selectivity may be an important factor. Since there is a much smaller group among the highly educated women who proceed as far as to parity two, they may also be more prone to have a third child.

The husband's education has a significant net effect only for couples having their second child in 1979. The effect is positive and larger than that of the woman's education.

The educational level of the woman's parents has only a small direct effect on fertility. Third birth probabilities are slightly higher for women whose parents have taken a secondary or higher education than it is for other women.

Our work casts some doubt on the relative importance of economic factors - at least for the fertility of two-child mothers - though we recognize the limitations of our income and employment variables. Women whose husbands have a particularly low relative income one year after the second birth have a subsequent fertility slightly higher than average. Apparently, higher income

does not turn into an increase in the "quantity" of children, and, as the educational level is controlled, we do not believe that the empirical result is primarily a manifestation of differences in contraceptive knowledge or use "quality" requirements, though we cannot be entirely sure. A more plausible explanation is perhaps that differences is "tastes" have resulted both in a strong preference for income-generating activities and a preference for fewer children.

In spite of the negative income effect, we cannot conclude that economic considerations are of minor importance in the fertility decision process for couples who already have two children. Also couples where the husband has a relatively high income may feel that they cannot afford to have an additional child, and that the economic conditions are the main inhibiting factor. Not only the income, but also the size of loans and savings, transmission of property from the parental generation etc. affect, of course, the individual perception of current economic strength. For instance, an economic pressure due to previous investments in, say, housing and previous consumption may have "trapped" the couple and impede a transition to parity three. The important lesson that can be learned from our analysis is that couples where the husband has a lower income, actually have a higher subsequent fertility, though one might perhaps tend to believe that they have a more strained economy.

There is a negative effect of full-time labour force participation the year after second birth on subsequent third birth fertility, but it is small, and only significant for women having a second birth in 1969. It is hard to interpret the results, as the employment status during this period is fairly inadequate as an indicator of real work intentions. For instance, some women may be homemakers the year after second birth not because of a very modest work commitment, but because they have not found satisfactory child care arrangements. If the same problems are likely to show up in connection with future childbirths, the third child will be very expensive in terms of economic as well as non-economic costs. The weak effect we have estimated may be explained by a low fertility in this group of women, a high fertility among other homemakers, many of whom have a low work commitment, and a moderately low fertility among those who have entered the work force one year after the second birth - perhaps with good access to kindergartens or other child care facilities as incentives. Another interpretation is that the economic, social and emotional losses associated with a reduction of the labour force activity, or the losses associated with the use of child care facilities, actually are considered as fairly small in contemporary Norway - not least because they are partly offset by the higher income the dual-earner couples have compared to those who have favoured a more traditional division of labour.

As opposed to the weak effect of economic factors, we have found that the regional variable, which is often left out in fertility studies from other countries, explains a considerable part of the individual variation in third birth probabilities. The intensity of the parity three transitions turns out to be lowest in the non-rural areas of Eastern Norway and highest in the rural areas of Southern and Western Norway. This may reflect differences in family values and norms, and in the supply of competing leisure activities. Economic factors, which we have not managed to control entirely, may also play a role. For instance, the direct costs of an additional child are probably lower in the rural areas due to less expensive houses, and the women may not have the same

opportunities for gainful employment.

Another indication of the importance of values for the fertility development and for the intracohort differentials is the large positive effect of being affiliated to religious denominations other than the Norwegian Church. It should be noted, however, that this is a very small group of couples, with values probably deviating much from those prevalent among the remaining population.

6.3 Explaining the downward trend in fertility

The factors included in the study are unable to explain the decline in third birth fertility. The only exception is the spacing between first and second birth. Rather than an "explanation" this should probably be considered as a reflection of a simultaneous decision. The women have preferred to have both fewer children and a somewhat wider spacing. Actually, the causality may run from fertility (expectations) to interval length. When a small family is intended, a tight spacing is no necessity.

A reservation should be made with respect to the economic factors, which may explain more than can be inferred directly from the model estimates.

Firstly, our variables may not capture well enough the real economic situation and the work orientation. Secondly, the conclusions drawn on the basis of differences within a second parity cohort are not directly transferable to a situation where there is a general increase in income and labour force participation over time.

Another argument is that even if there is no real effect on the third birth probabilities of the woman's commitment to occupational tasks, with age at second birth and other characteristics kept fixed, there might still be an effect on the cohort fertility. For instance, it is not unlikely that the postponement of first birth, which we have witnessed in Norway since the early 1970s, is partly caused by an increasingly strong desire or need to get well established in the labour market before family-building starts. A later first birth gives, in turn, a later second birth, and fewer progressions to parity three.

6.4 Unobserved fertility determinants

Evidently, a substantial part of the reproductive behaviour is left unexplained by our sociodemographic variables. We are neither able to account for the entire variation within a cohort nor the decline during recent years. This pertains to third births as well as total cohort fertility, and the comments below are meant to cover both fertility measures.

The logistic regression program that we have used gives a goodness-of-fit measure somewhat smaller than 0.3, and in our study of total cohort fertility, which has given very similar interconnections between fertility and the various sociodemographic factors, about one third of the variance or even less was explained (R^2 ranging from 0.21 to 0.36 in the models of cohort fertility for married women)

In an intracohort perspective the use and knowledge of contraception would be reasonable candidates to include in a model. These factors are partly, but not entirely, controlled by educational level. In addition, fecundity, other health aspects, sexual activity, and attitudes to and availability of induced

abortions may play an important role. Another crucial factor can be the supply of leisure activities to compete with familial activities or the rearing of a third child. Moreover, the individual preference structure with respect to activities and consumption undoubtedly account for a large proportion of the total variance. The family is faced with a situation where the rewards and pleasures from an additional child must be weighed against the satisfaction received from an alternative use of time and money. In this decision-making, which is, of course, not governed by strictly rational considerations, there is room for substantial individual variation.

It is equally difficult to explain the downward fertility trend across cohorts as the differences within a group of women delivering their second child the same year. For instance, we have very little information on the development of the socio-psychological or ideational factors. The declining fertility might be considered as an effect of pursuing self-realization in several arenas of life, and one might perhaps believe that a shrinking family size goes hand in hand with more time allocated to adult leisure activities that cannot be shared with the entire family (at least not with a small child) or activities that are so expensive that the price of an additional child is very high. Such a trend does not show up in the Time Budget Surveys (Lingsom and Ellingsæter, 1983), but the analysis and the data are not sufficiently detailed for our purposes.

One factor that should be added to the list of possible driving-forces for the declining fertility is the development and availability of birth control technology (Østby, 1989). With modern methods the risk of unwanted pregnancies is undoubtedly reduced. The importance of this factor is not easily assessed, however - not least because our knowledge of unwanted fertility is fairly limited. Obviously, a strong control over the "supply side" can be exercised also with traditional methods. On the other hand, despite the present technology and level of information the total abortion rate is as high as 0.5, which indicates that we are still far from the perfect contraceptive regime.

Also the rise in the number of induced abortions may have had a certain impact on the fertility development, but it is hard to quantify, as the number of illegal abortions is not well estimated. However, according to Noack and Østby (1984) abortions cannot explain more than a small part of the fall in the crude birth rates.

Finally, we refer to the so-called Easterlin hypothesis, which, in brief, contends that the high fertility in the 1950s was due to smaller cohorts reaching the reproductive and working age and thus obtaining a favourable labour marked position early in life, while the opposite occurred in the 1970s (Easterlin, 1980). Central to this idea is a concept of relative income different from that used previously in this report. Easterlin's relative income is the ratio of the earning potential, which is partly determined by the cohort size, to the material aspirations, which are influenced by the economic conditions in the younger ages. His hypothesis has attracted much discussion, and some attempts to test it have demonstrated the sensitivity with respect to choice of fertility measures, generation intervals etc. In a recent work by Wright (1989) it is concluded that there is little support for the Easterlin hypothesis in the Nordic countries.

6.5 Concluding remarks and speculations

Undoubtedly, several factors have reinforced each other to produce the low fertility level currently experienced in Norway compared to that exhibited by the 1935 cohort, which, in turn, was the result of a steep increase in cohort fertility that is not well understood. This analysis has shed some light on the recent fertility decline, but, of course, a bundle of questions remain unanswered. As expected, it is difficult to grasp the complex nature of reproduction, which encompasses rational decision-making, social, cultural and economic forces on the macro-level, biological factors and a substantial amount of chance. In addition, the data available to us have certain limitations, though it should also be emphasized that the large number of observations is very advantageous. Hopefully, the future analysis of the 1988 Family and Occupation Survey (Blom and Noack, 1989) will give more insight into the basic mechanisms of procreative decisions and behaviour in Norway.

This analysis has not uncovered a clear picture of the relative importance of the various driving-forces behind the recent fertility decline, and, of course, we do not pretend to be able to resolve the disputed question whether economic, social or ideational factors are the most crucial. We would like to conclude, however, that our study points to the importance of the non-economic variables.

If the downward trend in fertility primarily is driven by contraceptive improvements, by the emergence of an enormous supply of competing leisure activities and consumer products, or by changing preferences with respect to familial versus non-familial activities, this may have certain implications for our ideas about population policies - should such issues ever be on the political agenda - and future reproductive behaviour. For instance, one might argue that it would be particularly difficult to find an appropriate pro-natalistic policy, as some essential elements of modern life style, gender equality and technology hardly will be reversed. If there had been clear signs of low fertility among the economically disadvantaged, it would have been somewhat easier to suggest relevant political actions.

Changes in economic conditions are, of course, difficult to predict, but it is certainly not a more straightforward task to foresee the swings in social and cultural factors that are crucial for the trajectory of third birth probabilities and total cohort fertility. Several demographers hold the view that the ideational climate in the near future will be conducive to low fertility. For instance, Lesthaeghe and Meekers (1986) have suggested a continuation of below-replacement fertility, as "tolerance of non-conformism is likely to rise further and the shifts towards more post-materialism imply that other projects in life are likely to exert a great deal of attraction". However, we do not reject the possibility of certain revisions of the family values and the individual preferences in a more pro-natalistic direction, for instance because of a growing scepticism towards "consumerism" and "individualism" as essential building-blocks of modern human life.

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